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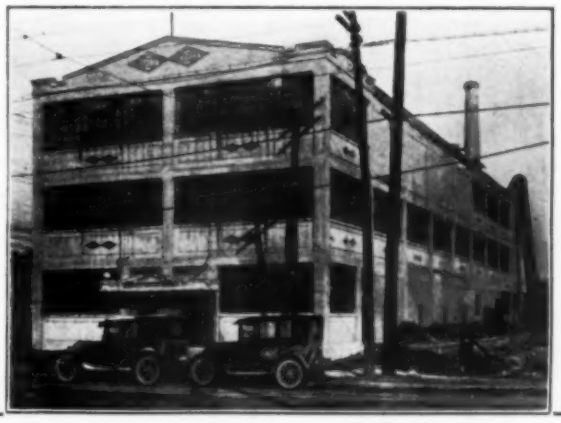
Operates Three-Story Shop

Complete and Smoothly Moving Mechanical Equipment Reduces the Number of Men Required and Shows a Production of 4000 Pounds of Castings for Each Molder Employed

GEOMETRY teaches the straight line is the shortest distance between two points. Efficiency further has instructed engineers who design manufacturing establishments that the straight line has its application in modern industry. Thus, for years past plants have been so constructed that materials in the process of manufacture move forward steadily in one definite direction. The straight line foundry, under stress of modern products demands, has been developed to a high state of perfection. Metals, sand, flasks and the numerous appurtenances involved in the production of castings are moved along without any backward or side step from the point of incidents to the point of completion. From sand and iron storage to the shipping room usually constitutes the extreme limit of travel in any modern foundry. Usually both these extremities and the territory between are in the same horizontal plane. That is, usual foundry construction confines all operations to one floor.

Exceptions to the foregoing may be noted in some cases, but these are only sufficient to prove the rule. The two-story foundry really is confined to a single floor so far as the actual molding, casting and cleaning operations are concerned. In an extremely limited number of foundries cores are made or castings cleaned in second floor quarters or in a basement beneath the main floor of the foundry.

The straight line principle literally has been up-ended in a recently completed gray iron shop at Indianapolis, built by the Lavelle Foundry Co. which already operates two shops at Anderson, Ind., and one at Argos, Ind. The new plant is noteworthy for many new ideas illustrated as well as for the peculiar plan previously stated. The straight line principle in routing materials and in performing the different operations is applied in a vertical instead of the usual horizontal direction. Progress in this case starts at the roof and is completed on the ground floor. A modern three-story building specially constructed to accommodate the equipment necessary to carry out this idea was constructed at West Michigan street



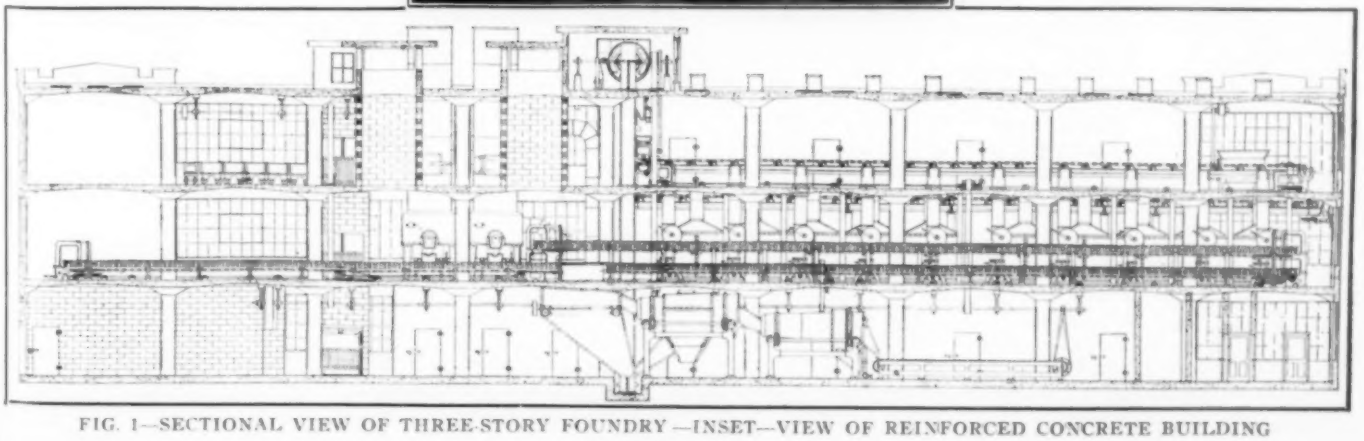


FIG. 1—SECTIONAL VIEW OF THREE-STORY FOUNDRY—INSET—VIEW OF REINFORCED CONCRETE BUILDING

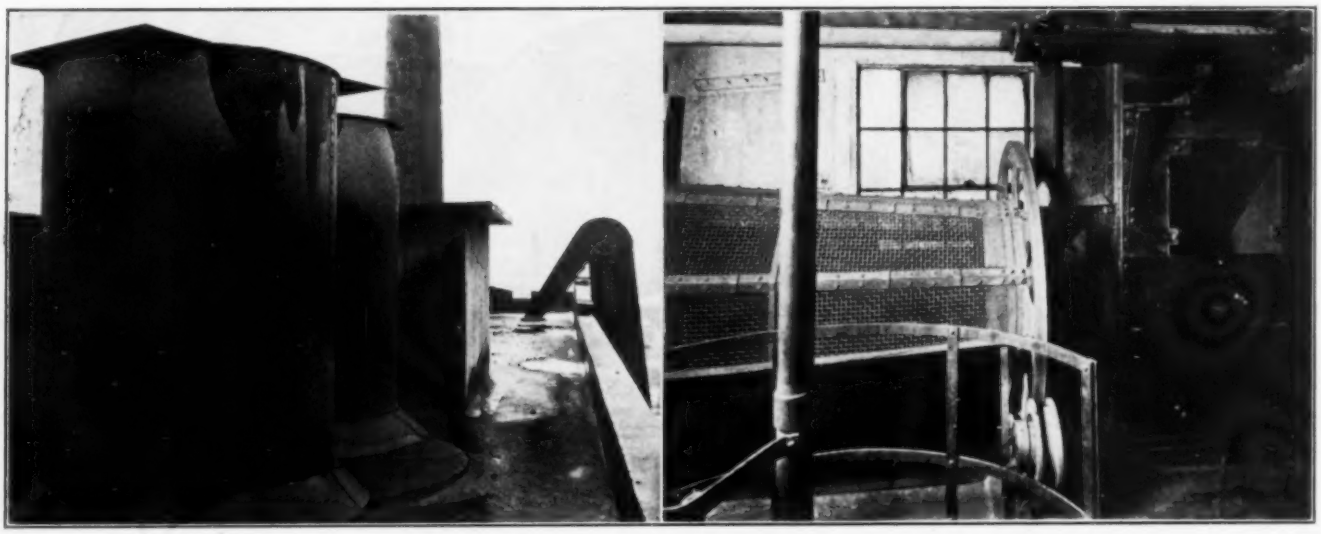


FIG. 2—COKE AND SAND ARE ELEVATED DIRECTLY FROM THE CARS TO THE ROOF AND DROPPED THROUGH TO BINS ON THE THIRD FLOOR FIG. 3—USED SAND RE-ENTERS THE SYSTEM THROUGH THE REVOLVING SCREEN WHICH IS HOUSED IN THE SMALL SHED BEHIND THE CUPOLAS IN THE ILLUSTRATION AT THE LEFT

and the Belt Line railway. A section through the three floors is shown in Fig. 1.

Before describing the plant itself, brief reference to the relation between the designer and the operating force perhaps may be of interest. An unusual circumstance brought an engineer with original ideas into contact with a family of practical foundrymen willing to back that engineer's judgment. James F. Stanley, who conceived and executed the design from the first pencil sketch to the finished operating foundry, is not a foundryman in the usually accepted meaning of the term. His previous experience along mechanical lines was supplemented by the foundry experience of certain members of the Lavelle family and those associated with them in the business. The plant has been operating only a short time, but a sufficient period has elapsed to demonstrate to the foundry owners the correctness of their judgment in backing the designer's idea.

In describing this unique plant, it will be well to start with the material entering the building and to follow its progress downward until it is delivered to the shipping room. As may be noted from the exterior view, inset on Fig. 1, a substantial reinforced concrete building adequately lighted and ventilated through steel sash windows, was constructed to contain the plant. A house switch from the Belt Line serves to deliver materials directly to the platform shown at the outside of the building. Pig iron and scrap will be stored across the track in bins provided for the purpose and designed to permit grading and segregating various classes. The metal and coke for the cupola charge are conveyed on specially constructed small cars directly to the charging floor which in this instance is the third floor of the building.

Coke and sand are hoisted by the bucket conveyor shown at the extreme right in the inset on Fig. 1, and is deposited in bins on the third floor through small elevated manholes visible on the roof in Fig. 2. Reserve sand storage bins are provided on the first floor, but these are not drawn upon except in emergency.

From the foregoing it will be seen that nearly all raw materials required in making castings are delivered to the third floor. This is the starting

Co-operative Effort

THE organization responsible for this foundry is co-operative to a high degree. John Lavelle, veteran foundryman and father of the others of that name connected with the firm, is president. B. J. Lavelle, vice president; T. A. Lavelle, secretary and treasurer; John J. Lavelle, James F. Stanley, J. E. Fogarty and W. J. Price own representative interests in the institution and are actively engaged. Each supervises some department of the work for which he naturally is equipped best. Each recognizes the qualifications of the others and in consequence close harmony and complete co-operation are secured.

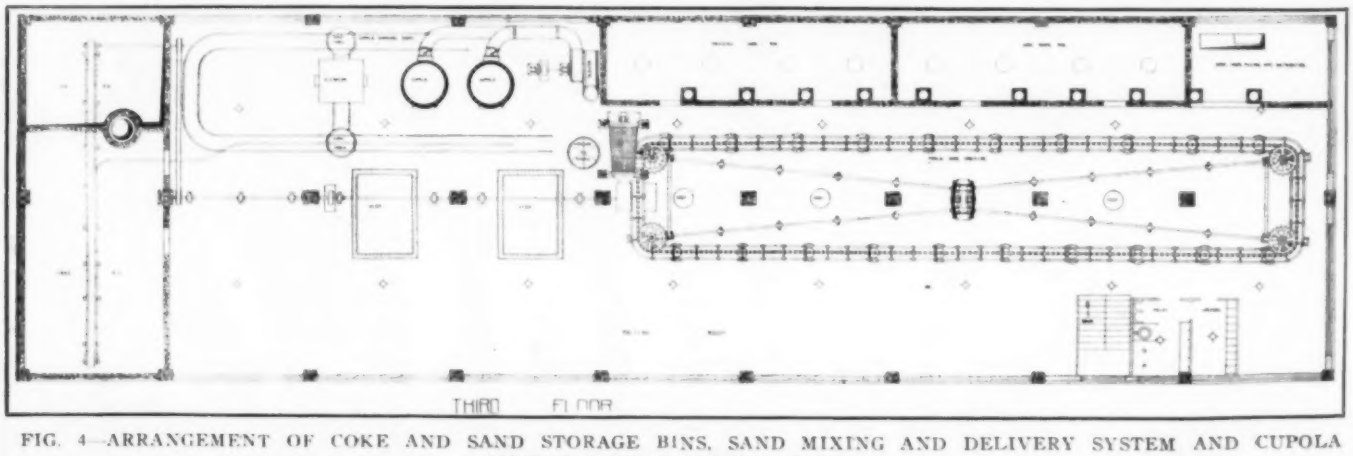


FIG. 4—ARRANGEMENT OF COKE AND SAND STORAGE BINS, SAND MIXING AND DELIVERY SYSTEM AND CUPOLA CHARGING ON THE THIRD FLOOR

point of the manufacturing processes, built on the basic idea which implies continuous operation. This requires that used sand shall be returned continuously to the point of beginning. Fig. 2 shows the point at which the used sand again enters the system. A bucket elevator brings this material from the first floor, hoists it to a pent house on the roof, and delivers it directly into the revolving screen shown at the left. The screen is tilted sufficiently so that tramp metal and any other larger foreign substances travel slowly toward the outlet and are dropped on the third floor behind the cupolas.

The sand from the revolving screen passes into a revivifier, a revolving drum carrying a series of staggered paddles that break up the mass of sand and aerate it. Some residual heat remains in the sand. A portion of this heating has been overcome by leaving the side of the delivery elevator from the shakeout floor open to the air so that steam may escape. Also the outer air has a chance to enter and mingle with the sand as it is carried into the screen.

Fig. 5 shows the point at which the sand enters a continuous conveying and mixing trough on the third floor. As the sand drops downward from the revivifier, it passes through a spray of water directed by an arrangement of perforated pipe. The amount of water required is determined by the operator in charge of the entire sand system. He can control it closely through the small valve shown at *A*, Fig. 5. In event that the various supply hoppers served by the continuous conveyor are fully supplied with sand, a transverse belt carries the sand back and deposits it in storage bins on the third floor. When it is desired to add new sand, this process is reversed and the belt brings sand from the storage bins to the point of entry shown in Fig. 5. This illustration shows how the control centers at this particular corner. A single operator in charge of the entire sand supply system stands at this station regulating the amount of water to be added, inspecting each small batch of sand as it passes, and governing the supply mechanism which controls the amount of sand in the continuous trough conveyor.

From the plan view, Fig. 4, it will be seen that something unique in the way of a sand supply system has been attempted. A continuous trough completes a circuit of 200 feet. Sand is moved through this trough by a series of vertical paddles 2 feet apart extending at right angles across the trough and carried on a series of small, fully enclosed bearings which travel on the edges of the sand through a trackway. These paddles are actuated by a link connected continuous belt driven by four sprockets, one at each corner, as shown in Fig. 4. The sprockets in

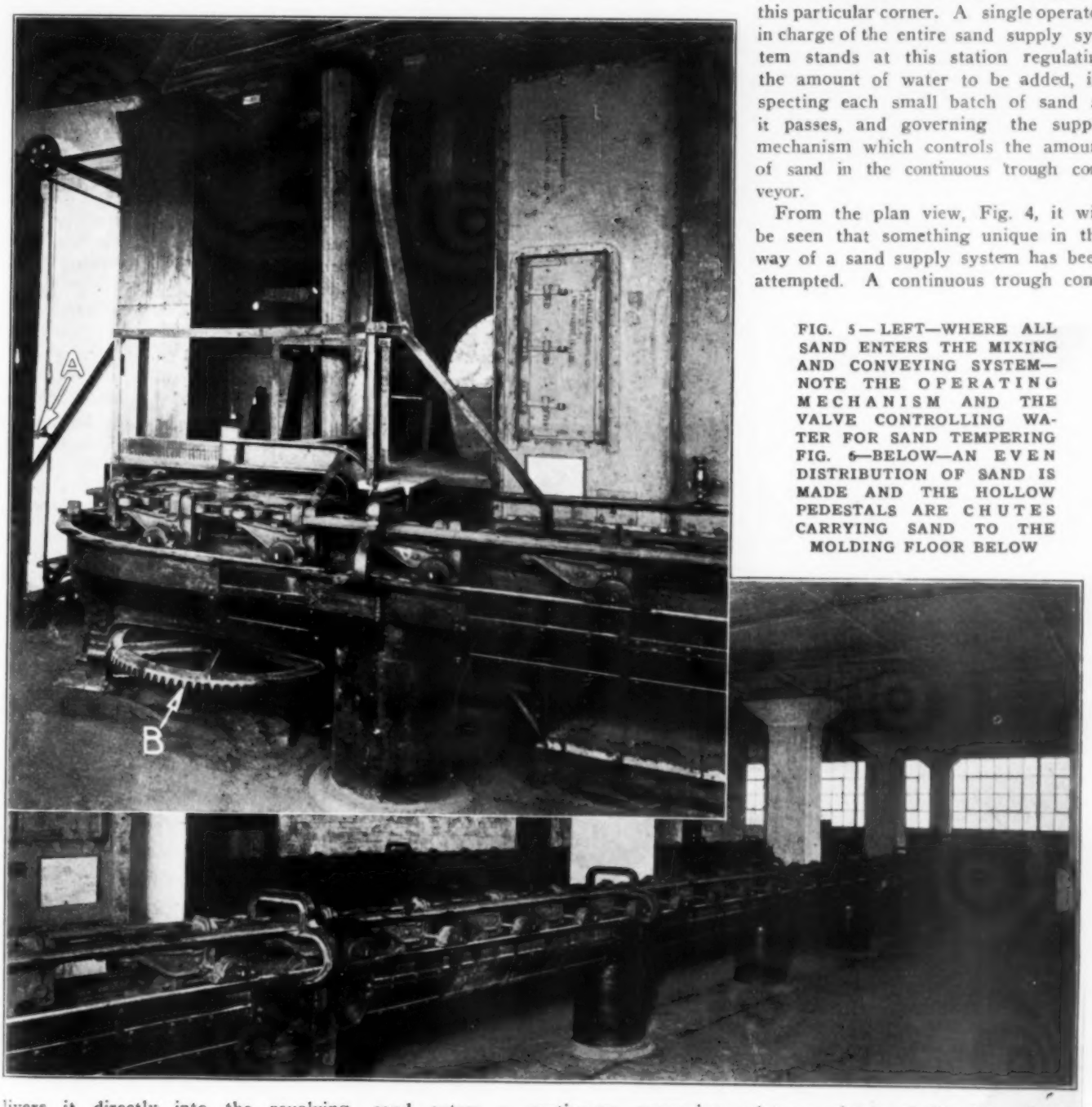


FIG. 5 — LEFT—WHERE ALL SAND ENTERS THE MIXING AND CONVEYING SYSTEM—NOTE THE OPERATING MECHANISM AND THE VALVE CONTROLLING WATER FOR SAND TEMPERING FIG. 6—BELOW—AN EVEN DISTRIBUTION OF SAND IS MADE AND THE HOLLOW PEDESTALS ARE CHUTES CARRYING SAND TO THE MOLDING FLOOR BELOW

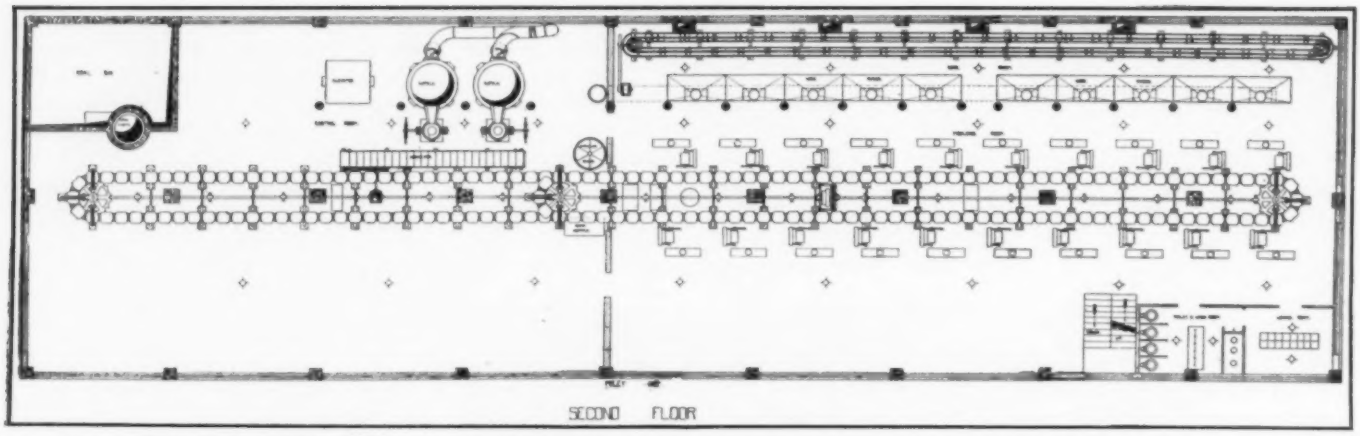


FIG. 7—GENERAL ARRANGEMENT OF MOLDING FLOOR, SHOWING POSITIONS OF MACHINES AND EQUIPMENT

turn are driven through a gear system located at the center within the conveyor enclosure. These gears, connected to the main drive shaft which will be mentioned later, actuate shafts terminating in bevel pinions which in turn drive the larger bevel gear wheels one of which is shown below the conveyor table at *B*, Fig. 5. The paddles within the conveyor trough travel at the rate of 80 feet per minute. The body of sand within the trough is broken up into small batches which are pushed along and carried around the entire system, passing over the hollow pedestals which serve to support the conveyor trough or table and which in turn act as delivery chutes carrying sand to the molding floor below. The manner in which it is delivered will be described later.

A notable feature of this conveying system is the manner in which all bearings are enclosed and rendered dustproof as shown in Fig. 6. The vertical thrust bearings carrying the sprocket and drive gear wheels at the corners, are enclosed and amply supplied with grease. The small roller bearings carrying the transverse paddles or pushers also are enclosed by a special housing which leaves only a small clearance above the edge of the trough. Grease is supplied through the small cups which may be noted. The roller carriages are attached by brackets to the link driving line above the central trough as shown in considerable detail in Fig. 5.

The supporting pedestals and delivery chutes are specially made castings set firmly into the concrete floor and provided with supporting brackets to carry upper guides for the endless chain drive system. The end trough itself is formed of a series of

Equipment Employed

	Manufacturer
Cupolas	Lavelle Foundry Co., Indianapolis
Conveyors	Lavelle Foundry Co.,
Sand screens	Lavelle Foundry Co.,
Cupola blower	The Spencer Turbine Co., Hartford, Conn.
Coke cars	Lavelle Foundry Co.,
Molding machines	Osborn Mfg. Co., Cleveland
Sand mixer	National Engineering Co., Chicago
Air compressor	Ingersoll-Rand Co., New York
Core ovens	Foundry Equipment Co., Cleveland
Tumbling barrels	W. W. Sly Mfg. Co., Cleveland
Sand blast	Standard Equipment Co., New Haven, Conn.
Grinders	Norton Co., Worcester, Mass.
Elevator	Home Elevator Co., Indianapolis

FIG. 8—THE POURING STATION IS ON THE FAR SIDE AT THE LEFT, THE SHAKEOUT IN THE FOREGROUND

small plates bolted on in sections so that individual sections may be removed and replaced when worn out.

A small enclosure devoted to the core sand mixing and distribution department may be noted at the corner shown at the upper right in Fig. 4. A revolving muller type mixer has been installed to mix and prepare the core sand. The prepared sand is delivered through the floor to a smaller continuous conveyor mounted on the ceiling directly above the coremakers' benches on the second floor. This will be described in detail in connection with mention of the second floor layout.

The arrangement of the cupola charging floor also is evident from Fig. 4. It will be seen that the elevator serves the third floor directly beside the cupolas. Charging cars are pushed off this elevator and upon a turntable and then are carried to the U-shaped storage track shown at the left. Coke storage, provided on this floor, is at the extreme end of the building.

The remainder of the third floor or the entire, well-lighted side to the west, has been set aside for the pattern room. A significant feature of this foundry is the fact that the charging floor and sand mixing departments can be operated on the same floor and so closely in connection with the pattern shop without discomfort and damage arising from the conditions which sometimes surround the operations of cupola charging and sand handling.

Following the sequence of operations to the second floor perhaps it is best to consider first the sand. Figs. 9 and 11 show the delivery end of the chutes which support the conveyor on the third floor. It will be apparent that these delivery pipes always are full of sand. A clever device has been adopted to restrain this sand and to deliver the required amount to the molding machines. This delivery system involves essentially a continuation chute or hopper pivoted on an upright shaft and opposite to a flat horizontal plate which comes into position under the chute when the hopper is swung out of the way, as shown in *C*, Fig. 9.

The hopper, shown in position at *D*, is provided with a small slit or observation opening through which the molder may look directly down upon the sand which has been shaken into the flask. The flow of sand may be stopped instantly when the desired amount is delivered. The delivery system is unique and has been designed especially for this work. Bolted to the portion of the sand delivery chute which may be designated as the downcomer pipe, is a supporting casting which carries a circular perforated device similar to a round fan and made by pressing blades from a circular plate. This device is supported in a horizontal position and serves to hold back the great body of sand in the chute. It is mounted on its outer circumference on the casting shown at *E* by a geared ring moving on dust-tight bearings. A sprocket engages the outer ring and is operated through the crank and chain shown at *F*. When the crank is turned the sprocket is actuated, turning the ring and rotating the fan shaped plate inside the chute. This rotation permits a portion of the sand to be scraped away by the fan-blade segments and dropped down through the hopper into the flask beneath.

FIG. 10—THE POURING GANG IS CARRIED ALONG ON A MOVING PLATFORM BESIDE THE MOLD CONVEYOR, MOVING AT THE SAME RATE OF SPEED

FIG. 11—THE PLATES OF THE MOLD CONVEYOR ARE BEVELED TO PERMIT THEM TO TURN AT THE ENDS OF THE SYSTEM

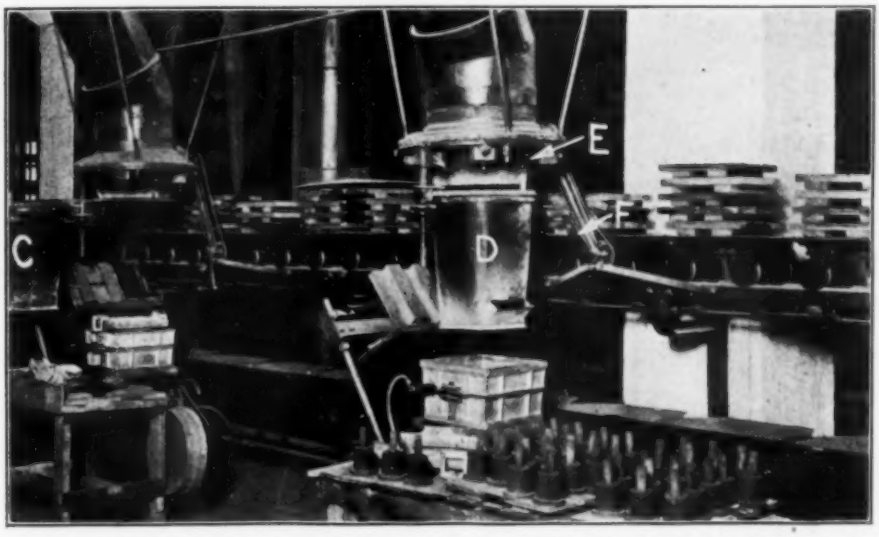


FIG. 9—SAND IS DROPPED DIRECTLY INTO THE FLASK ON THE MACHINE BY TURNING A CRANK OPERATING A CONTROL DEVICE ABOVE THE DELIVERY HOPPER

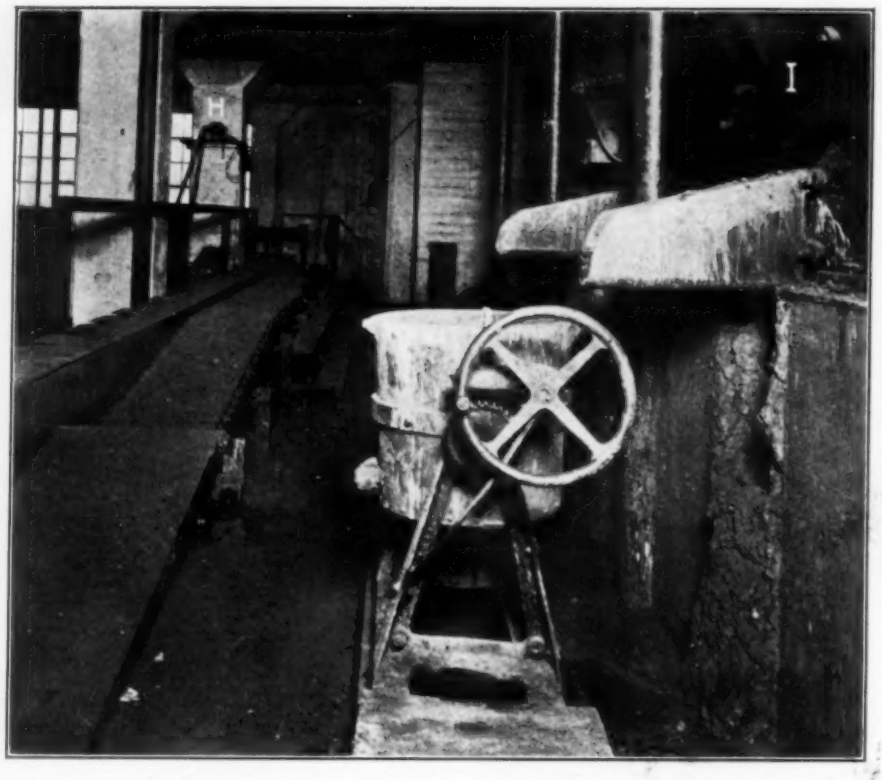


FIG. 12—A RECEIVING LADLE MOUNTED ON ROLLERS MAY BE MOVED BENEATH THE SPOUT OF EITHER FURNACE—THIS LADLE IS TURNED TO PERMIT METAL TO FLOW FROM THE LOWER SPOUT

The degree to which this actuating device is turned regulates the amount of sand delivered on the pattern, so that it is possible to graduate this amount accurately from a slight sifting to a complete flaskful, depending upon the way in which the crank is turned. This device insures close control and prevents delivery of an excess amount of sand which otherwise would have to be gathered up afterward and returned to the sand handling system.

A battery of 20 squeezer machines is located around the mold carrying system, as shown in Fig. 7. Each molding machine constitutes a separate unit. The work which is handled in this foundry has been standardized as to size so a 14 x 16-inch flask is standard for the entire shop. Pattern plates are used and the cope and drag are rammed together.

The mold conveying system consists of a series of small plates with the corners trimmed to permit their being moved around the circular ends of the system as shown in Fig. 11. Each plate is mounted on four ball bearing wheels and each wheel is pivoted so that it may follow the curve of the track. Each plate with its supporting trucks is moved along the trackway by a continuous chain to which it is attached by a suitable bracket directly under the center of the plate. The endless chain in turn is drawn forward at an even speed by large sprocket wheels at opposite ends of the conveying system. These horizontal sprocket wheels are actuated through gears from a line shaft located above the floor. The trackway supporting the conveying system is carried upon mountings set firmly into the concrete floor. It has been leveled so carefully that the engineer in showing the evenness of motion and the level, smooth condition of the track, placed a three-inch lead pencil on end on one of the mold-carrying plates. It traveled entirely around the system without toppling from its horizontal position.

The upper conveying system designed to carry the bottom boards is similar in every respect to the mold carrying conveyors. The upper trackway is carried on brackets fastened firmly to the main building columns.

In operation each molder makes a complete mold, removes his snap flask, and sets the mold on its individual bottom board on the continuous conveyor shown beside the machines in Fig. 9. A constant supply of bottom boards is available on the upper conveyor as shown. The necessary cores at present are delivered to a table at the side of the molder, but in the future a conveyor will be installed which will deliver a rack of cores to any station as desired.

Each mold as it is made bears a number identifying the molder and specifying if the casting is cored. As it moves around the conveyor in a counter clockwise direction, the mold is tallied by a checker standing at the side of the conveyor and ahead of the pouring station. Then, as each successive mold is carried forward past a point near the pouring sta-

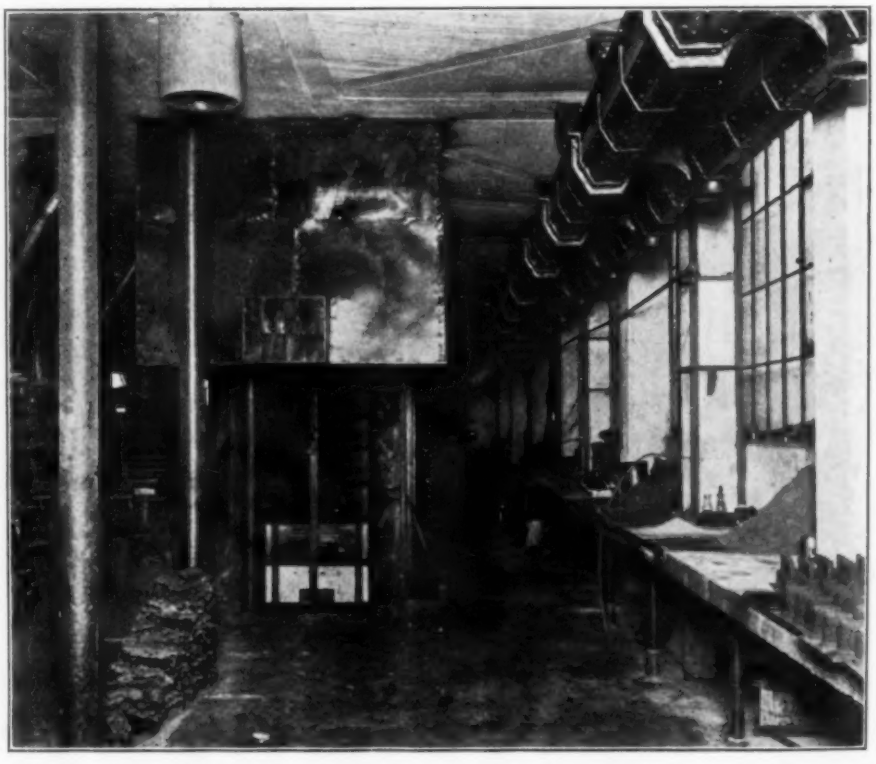


FIG. 13—THE SAND CONVEYOR MOUNTED ON THE CEILING SUPPLIES THE COREMAKERS' BENCHES—THE OVEN SHOWN IS THE FIRST OF A SYSTEM TO BE INSTALLED AS MORE ARE NEEDED

tion, a workman puts on a slip case and a weight just before the mold arrives at the pouring station shown in Fig. 10. A fixed, inclined platform leads from a point directly in front of the cupolas up to a moving endless belt platform placed parallel with the mold carrying conveyors. Thus, the workman catches a ladle of iron at the cupola, turns directly around to the moving platform and pours the mold as he is carried along beside the endless conveyor which handles the molds at the same speed of 40 feet per minute. The molds then are carried around, permitting the metal to cool until it reaches the dump chute shown behind the sand piles in Fig. 8. Two chutes are provided leading to the floor beneath. Into one of these a workman empties molds which by their markings indicates that the castings are cored, while into the other he shakes out the uncored castings, for reasons which are stated later in this article.

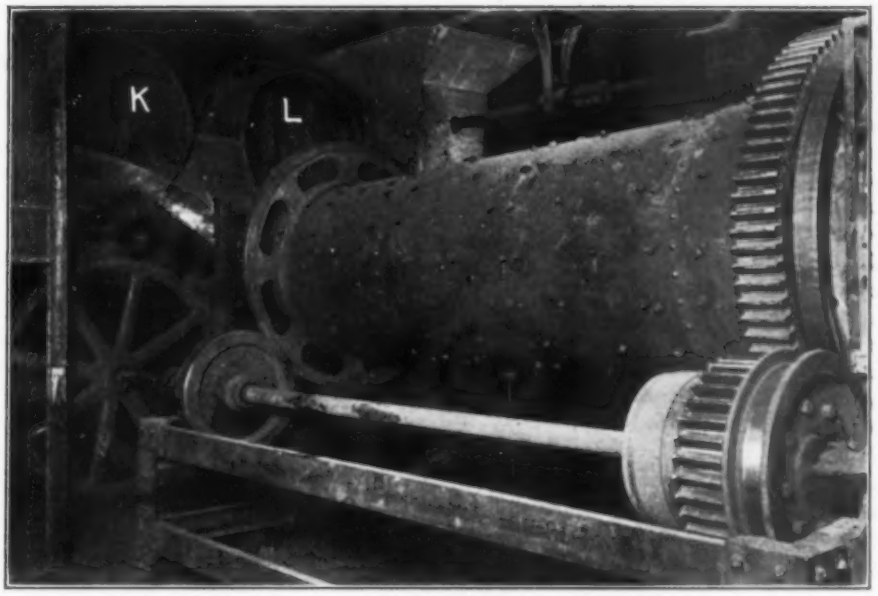


FIG. 16—COMING FROM THE HOPPER SHOWN IN FIG. 16 THE CASTINGS PASS THROUGH THE REVOLVING BARRELS

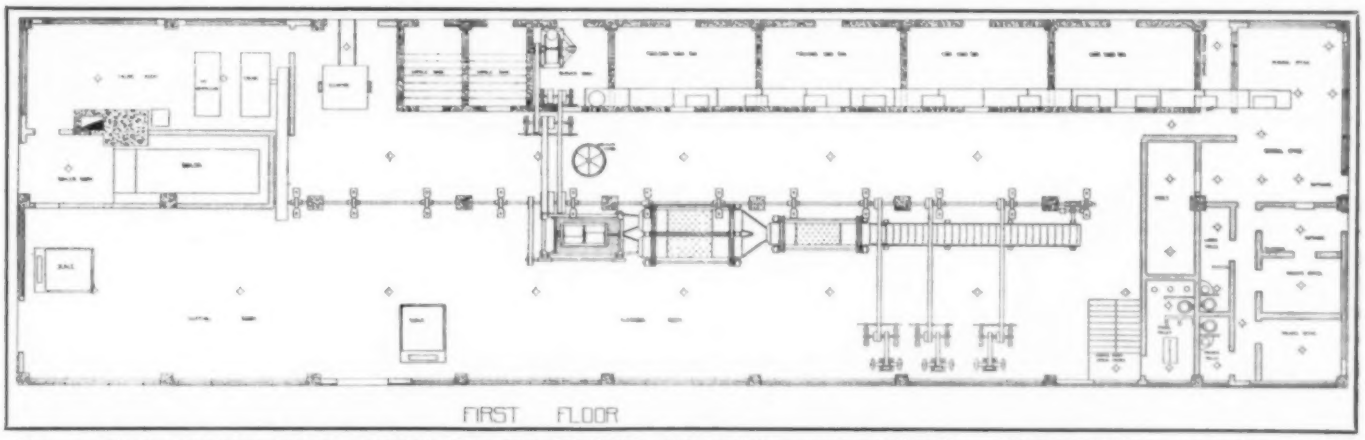


FIG. 14—THE GROUND FLOOR CONTAINS THE OFFICES, CLEANING AND SHIPPING DEPARTMENTS, RESERVE SAND STORAGE COMPRESSORS AND MOTIVE POWER

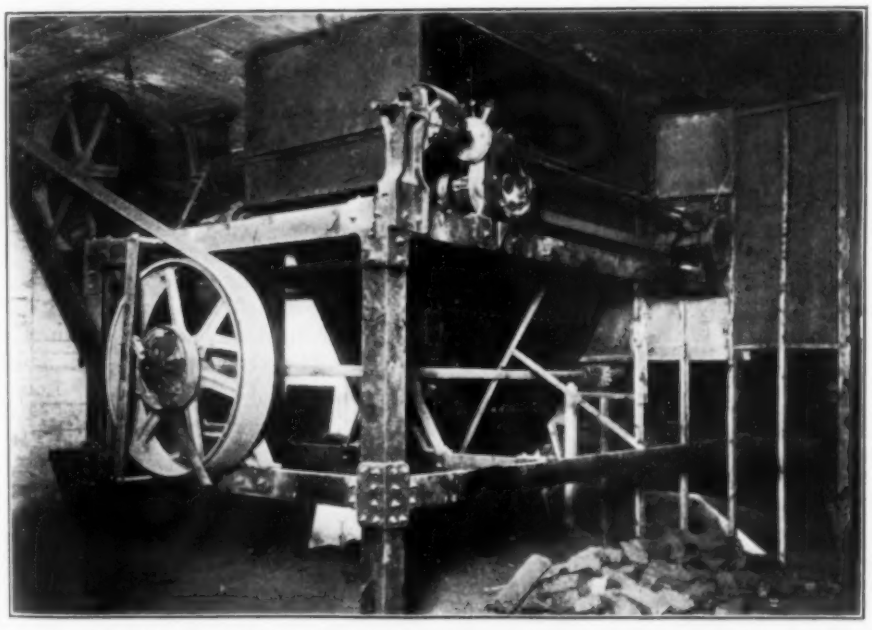


FIG. 16—COMING FROM THE HOPPER SHOWN IN FIG. 16 THE CASTINGS PASS SHOWN AND PASS INTO REVOLVING CYLINDERS

The actuating mechanism of the two conveyors is apparent from Figs. 7 and 11. A main system of driving gears, belt driven from the floor below, rotates a continuous shaft which in turn is geared to the large drive wheels at opposite ends of the system. Further, a separate system driven from the same shaft actuates the large sprockets on the upper conveyor used to carry bottom boards or other supplies to the molding stations. The speed of the mold conveyor is 40 feet per minute, synchronizing both with the bottom board conveyor system and with the pouring platform. However, the latter is driven by a separate small motor shown at *H*, in Fig. 12. This motor actuates a series of pulleys and through them the single sprocket which drives the pouring platform. The latter consists of a series of bolted plates mounted on jointed sections and fastened together by links which in turn are supported on small wheels, as shown in Fig. 10.

The castings with their gates, the sand from the molds, and in fact

the entire contents of the flasks as they are removed from the molding conveyor are dumped through chutes to the first floor. The uncored castings and the sand surrounding them are received in one-half of the hopper shown in Fig. 15. The castings are caught on grates formed of a series of flat bars set edgewise. These bars are far enough apart to retain the castings but permit the sand to sift through into the bottom of the hopper. This hopper communicates with the sand elevating conveyor mentioned previously which conveys this material to the pent house located on the roof, where it passes through into the system again. The castings which have dropped upon the grate are moved along by the bars of the traveling grate. Alternate bars move upward, forward, downward and backward in turn, so that the castings in effect are walked forward and dropped into the rotating cylinder or barrel shown at *K*, Fig. 16.

The uncored castings enter this barrel where they are rolled and tumbled, progressing forward and finally pass into the second horizontal tumbling barrel shown in the foreground. The cored castings drop through a chute into the other half of the grated hopper, whence they travel to the second tumbling barrel shown at *L*, which as will be noted, contains a a series of baffle projections and chains which jar loose and beat out the core sand. The spent core sand falls directly through openings in the barrel into a waste heap from whence it afterward is removed. The violent action to which the castings are subjected as they are thrown about in the series of barrels shown serves to remove some of the gates and risers. The company intends to sandblast the castings in the second barrel through which they pass, but at present they are removed to separate sandblast units. As the castings come from the tumbling cylinders they pass out upon a continuous moving inspection table where they are sorted and those requiring grinding are sent directly to the grinders shown in the lower portion of Fig. 14. The time occupied from the shakeout to the preliminary inspection is about four minutes. The small castings are placed in sacks loaded on small wheel trucks and carried back to the scale in the shipping room, shown at the left in Fig. 14.

The core room occupies about half one side of the second floor, along the east wall. An overhead sand conveyor similar in type to that which supplies molding sand, keeps a constant supply of core sand available. This is delivered through suitable openings as shown in Fig. 13, directly upon the coremakers' benches as desired. An electrically-operated gate controlled by pushbutton from the coremaker's bench permits sand to be dropped when desired. Cores are made and placed in the drawer type oven shown in the background of Fig 13. A pipe equipped with a centrifugal fan has been installed in this oven which will convey waste heat from the cupola stack to dry the cores. This oven is the first of a series to be built.

Either one of the 72-inch cupolas, lined to 36 inches, supplies metal sufficient for full operation. The position of these cupolas is apparent from the plan view, Fig. 7, and also from Fig. 12. The cupolas are mounted on concrete foundation walls and a special chain operated device has been provided for raising the drop-bottom doors into position where they may be wedged firmly against an I-beam at the second floor level. This device consists of a crank and ratchet turning a shaft which winds up chains fastened to the doors at the opposite sides. Special type drop-tuyeres made by the Lavelle company are provided. These are bolted on beneath the windbox as shown at *I*, Fig. 12.

A slag opening is provided in each cupola at the rear and the slag drops directly through to the first floor into waste bins.

An ingenious receiving ladle is mounted on a special frame which in turn travels back and forth on parallel tracks in front of the two cupolas. The ladle is operated by a screw and gear mechanism actuated by a hand wheel. Metal is tapped into the ladle at the top, but is drawn off through a spout near the bottom of the ladle. This arrangement constitutes an effective skimming device. The ladle is tilted backward so that the lower spout is elevated when hand ladles are not available to receive the metal.

The first floor, as may be noted from the plan, Fig. 14, is occupied by the offices of the company, the reserve sand storage bins, the motor driven air compressor, the cupola blower, and the main motor which drives all of the moving continuous conveyors, the sand handling system, the shakeout hoppers, tumbling barrels and sandblast barrels. This 30-horsepower motor unit made by the Allis-Chalmers Co., is belt connected to a line shaft as shown in the first floor plan. From this lineshaft are taken the various drives which have been mentioned, together with the auxiliary equipment such as the cupola blower, the proposed core oven heat blower, grinders, etc. A test of this motor to ascertain if it was not overloaded showed that for a period of 8 hours it averaged a delivery of 28 horsepower.

No effort is spared to make every part of the equipment readily accessible. Small stairways and platforms passing across the mold conveyor as shown in Fig. 8 permit workmen to pass without going around the end of the conveyor system. A circular steel staircase extending from the first floor to the roof permits instant access to any portion of the operating foundry, while a main stairway at the front of the building also is provided. A ventilating shaft shown at *M*, Fig. 8 has been installed. It will be enclosed and suction draft provided to remove the smoke and fumes at the shakeout station located almost directly beneath.

This foundry only has been placed in operation recently and, therefore, no figures are available on economy of labor in its operation. However, with eight molders active a total production of 16 tons of castings per day weighing less than 24 ounces each has been secured. Among the eight molders various degrees of efficiency are noted. One workman has put up as many as 380 molds in an 8-hour day. When eight molders are employed, six men are required to handle the iron, three men operate the cupola, one supervises the sand handling system, tempering the sand, etc., one applies the slip jackets and weights, and three men supervise all the details in the cleaning and shipping departments.

Opens New Warehouse

The Hillside Fluor Spar Mines, 38 S. Dearborn street, Chicago, has established a branch warehouse at Broadway and 15th street, Cleveland. A stock of washed gravel and coarse ground fluor spar as well as iron foundry flux will be maintained for quick shipment to points within the district. The company also maintains warehouses in Chicago and St. Louis.

Peckham Brass Foundry, Inc., 155 A street, Boston, recently was incorporated to take over the business of F. W. Peckham, brass founder, at that address. The company manufactures brass, bronze, composition and aluminum castings. No immediate expansion is planned by the present management.

Compare Steel Refractories

Suggestions Offered for Improving Qualities, Methods of Construction and Maintenance of Open-Hearth Furnace Linings—Outline Problems of Electric Furnace Materials

BY E. C. KREUTZBERG

INFORMATION of value on the refractory linings of open-hearth furnaces was presented in the sessions of the refractories division of the American Ceramic society, at Atlantic City, Feb. 6. However it was apparent during the lengthy discussion, that much further clarification is needed. One of the questions extensively discussed was whether it is more economical to line its open-hearth furnaces with cheap brick, or with material having a much higher first cost, but a long life. Numerous expressions of opinions and facts on this question were offered but no adequate conclusion was reached. Several speakers declared that progress would be much more rapid if the operating companies co-operated more freely with the refractory engineers and gave them all the facts connected with the performance of brick in operation.

That cone tests do not afford an accurate measure of temperature withstanding ablity of refractories was stated by several speakers. Cones themselves, it was shown, give uniform results only when those made by the same manufacturer are used. Cones made by American, British, French and German manufacturers were shown to give results that in numerous cases differed by two numbers. Further, it was stated, there were cases where brick fusing at cone 27 or 28 had given much more effective service in the checker work in open-hearth regenerators than 31 or 32 cone brick. The test is regarded as valuable in that it shows the relation of the cone to the refractory qualities of the material under investigation. However, it was the sense of the meeting that if the test is associated with temperature, rigid specifications must be prepared so that cones will be uniform and tests will be conducted uniformly. This matter was referred to the committee on standards, which is to co-operate with the bureau of standards and report developments.

Need exists for considerable improvement in the design of the open-hearth furnace, it was pointed out, because the average life of the open-hearth refractory lining is too short. It was stated that under the most favorable circumstances the installation and maintenance of open-hearth linings costs at least 30 cents per ton of steel produced, and the average is considerably higher, especially when pulverized coal is used as the fuel. The efficiency of refractories in open-hearth furnaces is low.

C. P. Spangler, Jones & Laughlin Steel Co., in speaking about the cost of open-hearth refractories in making steel, said that the three elements are labor, material and furnace time. He spoke of the lack of good firebrick specifications, and said that his company values firebrick from the standpoint of its service life per ton of steel, rather than in dollars per thousand of brick.

Demands Care In Building

D. J. Matheson, Bethlehem Steel Co., explained the practice of his company in lengthening the life of furnace roofs. In discussion it had been pointed out that a part of a brick in the roof frequently breaks off and falls out, leaving a hole which speedily develops into a weak spot and hastens the necessity for rebuilding the roof. Mr. Matheson stated that these cases generally are not due to the quality of the brick, but rather to the manner in which the roof is constructed. When rebuilding a roof at Bethlehem, the required brick are taken out of one lot so that they will all be alike in quality. They then are gaged to insure uniformity of size, although the company allows a variation of ¼ inch per foot in the gaging, which it finds more liberal than is necessary. The brick are put in place in the roof without anything between them, and care is taken in keying the brick so that both the inner and outer edges will be in contact across the entire arch. When the furnace is fired, the brick in the new roof expand, and operators compensate for this expansion by slackening the tie rods. Thus the pressure is kept distributed uniformly across both the top and bottom edges of the bricks, and consequently there is no shearing pressure which would cause the bricks to break and fall out. This is exceedingly important, said Mr. Matheson, because a brick glazes only on its original skin, and the inner surface which is exposed to the flame after part of a brick falls out, will not glaze, so that the less refractory interior of the brick fuses in the high temperature and a weak spot in the roof results. As a result of this method, Bethlehem has overcome 90 to 95 per cent of its roof failures, he said.

In discussing fire clay brick for open-hearth furnaces, M. C. Booze, Mellon Institute, Pittsburgh, said highly refractory brick, 31 or 32 cone, is essential. The principal cause for failure in the checkers is the slag and dust which is carried by the gases from the furnace into the regenerators.

Silica brick for the open hearth was discussed by H. C. Harrison, bureau of mines, Columbus, O. Roof failures are caused principally by slag action, he said, and a silica roof lasts about three times as long in an acid as in a basic furnace. Suspension of the roof from water cooled supports, he said, lengthens the life, but care should be taken not to have any excess cooling. Silica brick does not withstand enough heat, and it spalls and is decidedly acid, but it is abundant and has other advantages. Mr. Harrison spoke of the value of subjecting silica brick to heat before installing them in the furnace. One steelmaker, put silica brick in the regenerator and after leaving it there for some time, he removed it and built the back wall of the furnace from this brick and this wall proved to have about double the life of the ordinary silica back wall built of brick as received from the refractory plants.

Chrome brick were recommended for certain parts of the open-hearth and other equipment, by R. E. Griffiths, E. J. Lavino & Co., Philadelphia. In the past two years, he said, 18 furnaces with working bottoms of chrome brick below grain magnesite, have placed in operation, and a total of 231 open-hearth furnaces now have bottoms which are partly chrome. Experiments with chrome bricks now are being conducted at plants having 106 open-hearth furnaces. As an instance, he said, a furnace with a chrome working bottom and with chrome brick in the lower portion of the back wall, still is operating satisfactorily after 8½ months, and was believed to be good for an additional four months. The use of chrome brick multiplies the life of the backwall by five or six.

One of the most interesting papers of the session was read by Sidney Cornell, New York. He acknowledged the merits of chrome brick but said that chrome brick cost $210 per thousand, compared with around $40 to $45 for

silica brick, and that second and third quality silica brick may be had at much less. Mr. Cornell alluded to the open-hearth furnace as a bad piece of engineering and said that it has a tremendous lining cost as compared with other units which have refractory linings. The lining cost varies according to the fuel, and he estimated that the lining costs about 30 cents per ton of steel when operating the open hearth on natural gas, 60 cents on producer gas and $1.20 on powdered coal. Mr. Cornell told of the experience of one steel plant having 24 open-hearth furnaces, each 50 tons, and using natural gas. This plant during a year made 16,788 heats, had 80 repairs to furnaces, had one furnace last only 79 heats and another that lasted 318 heats on one roof, and the average was 189 heats per roof. The time lost averaged 2500 hours per repair, 4 per cent of the plant capacity was lost during the time expended on repairs. It is highly desirable, Mr. Cornell said, that such improvements are made in the design as will make of the open-hearth furnace a more permanent structure.

C. E. Williams, bureau of mines, Seattle, said that in an oil-fired furnace the roof is burned more rapidly but the furnace operates faster on oil than on gas. A better designed regenerator which will not clog with dust is needed. The best regenerators have larger openings at the top, the size of the openings decreasing toward the bottom. Another good type, he said, has large openings at about the center of the checkerwork, permitting the deposited material to be blown out.

Electric brass furnace refractories were discussed by H. W. Gillett and E. L. Mack, bureau of mines, Ithaca. Mr. Mack, who presented the paper, first mentioned the annular resistor type of furnace. In this furnace it is difficult to maintain the roof, but particularly the resistor trough. The problem of lining the moving indirect arc type furnace is not difficult, excepting where zinc vapor permeates the portion of the lining which is not washed by the metal, with consequent deterioriation in this portion. In this type of furnace a lining should not be used too long. After a certain number of heats, even though the lining still is serviceable, the cost of a new lining is more than compensated by the higher thermal efficiency of the new lining. Mr. Mack favored as few joints as possible and said that attempts to make moving indirect arc type furnace linings in one or three pieces should be encouraged. The induction furnace in which the heat is generated in the metal itself, has advantages which make this furnace desirable for use with the higher temperature copper alloys, but the lining now available does not permit successful operation above 1100 degrees Cent.

E. L. Crosby, Detroit Electric Furnace Co., said that in his furnaces about 200,000 pounds of brass, or about 1500 heats, are being obtained per lining. The principal problem now engaging his engineering department is the development of a lining for producing synthetic gray iron. A big field exists for the electric furnace in producing gray iron synthetically if an adequate refractory is developed that will last 300 to 500 heats.

Dr. F. A. Harvey was elected chairman of the refractories division of the American Ceramics society for the ensuing year. C. E. Bales was elected vice chairman and R. F. Ferguson secretary.

At the meeting a definition of silica brick was reported as tentative. It was stated that members of the division are co-operating with the American Society for Testing Materials in formulating standards for firebrick. Owing to the extensive scope of the discussions, the entire program was not completed. A question box on the subject of cupola block had to be omitted, but this is to receive early attention in the society's bulletin.

National Car Wheel Co. Sale Confirmed

Sale of the National Car Wheel Co., Pittsburgh, with plants in Cleveland, Rochester, N. Y., Sayre, Pa., and West Homestead, Pa., to the American Brake Shoe & Foundry Co., New York has been confirmed. The purchase price of the stock was not disclosed but the amount involved is approximately $2,000,000. The sale involves the Pennsylvania Casting & Machine Works, a subsidiary concern located at Preble avenue, North Side, Pittsburgh.

According to Andrew Muirhead, formerly assistant secretary of the National Car Wheel Co., just elected treasurer of the reorganized company, the Pittsburgh headquarters in the Keystone building will be maintained. William F. Cutler of New York, is the president of the new organization; George M. Judd was named secretary; Joseph B. Terbell, chairman of the board of directors and Andrew Muirhead, Pittsburgh, treasurer. C. M. Bower, Frank C. Turner, J. H. Yardley and E. H. Chapin, all of New York, were named vice presidents together with J. F. Weisbrod of Pittsburgh.

The National Car Wheel Co., was formed in 1903 as the result of the consolidation of the Keystone Car Wheel Co., Pittsburgh; the Rochester Car Wheel Works, Rochester, N. Y., the Cayute Wheel & Foundry Co., Sayre, Pa., and the Mather Wheel & Foundry Co., Cleveland. The annual output of the combined companies was 120,000 tons.

Offer Operating Data On Air Compressors

The Ingersoll-Rand Co., 11 Broadway, New York, has issued a 39-page booklet in which the straight line belt-driven air compressors made by the company are fully described and illustrated. This booklet gives complete instructions covering the installation of these compressors and the assembly of parts and their functions.

Part I tells how to locate and install the compressors, how to build the foundations, to install the air receivers and piping for air and water. As these compressors always are shipped with the wheels removed from the shaft, full instructions are given for replacing them.

Part II covers operation, special attention being given to lubrication including recommended grades and quantities of oils. This section also deals with the adjustment of the compressor parts, such as main bearings, crank, and crosshead pin boxes, air cylinder valves, etc.

Part III describes the short belt drive which is provided when specified. This short belt drive consists of an idler pulley placed on the slack side of belt, close to the driving pulley. The idler pulley is carried on an arm swung from the compressor frame, free to rise and fall with the belt, to take up the slack and hold the belt against the driving pulley. Instructions covering its installation, care of belt, etc., are given.

Part IV covers various regulating devices and piping arrangements and gives full information as to automatic control afforded.

The booklet which is one of a series offered to the operating man, contains many suggestions for operating this type of compressor and precautions to be observed in maintaining its efficiency.

Presents Sand Blast Equipment Data

The New Haven Sand Blast Co., New Haven, Conn., has issued a 56-page booklet in which sand blast equipment for foundries is illustrated. Their various products of this company are shown such as conical gravity, and sand-blast barrels, sand blast rooms, cabinets, including the rotary table types, pressure-type automatic hose machines, which are furnished with the direct pressure barrels and dust arresters. A number of drawings covering the general arrangements of sand blast rooms with penumatic sand elevation and gravity feed also are included.

The Detroit Electric Furnace Co., Detroit, has moved their office to 2331 First National Bank building, that city.

Operations Affect Linings

Factors Causing Deterioration of Both Acid and Basic Open-Hearth Furnaces Reviewed—Refractory Which Increases Production with a Lower or Equal Cost Per Ton of Steel Is Desirable

BY CHARLES A. SMITH

CONSTRUCTION of acid and basic types of open-hearth furnaces is practically the same with the exception of the hearth, which of necessity must be acid in the one case, and basic in the other.

The life of the acid furnace is much greater than that of the basic, frequently being 1000 heats. This is due to the entire lining of the acid furnace being of the same chemical nature as the slag, which is relatively small in amount, and because no volatile fluxes are added to the charge. The chief active corrosion of the acid-furnace lining results from iron oxides attacking the silica hearth at the edges of the bath where greatest oxidation occurs, and from the scorifying action upon the hearth of molten metal, oxidizing as it is being melted. Steel scrap, if charged on the hearth, will attack the hearth greatly in melting due to the large percentage of oxide in the scrap.

The life of the basic open hearth is much less than that of the acid hearth, rarely being over 350 heats. The shorter life of the basic furnace may be ascribed to a large part of the lining being chemically opposite to the thin, highly corrosive, basic slag, and the furnace atmosphere which is laden heavily with highly basic vapors, flux dust, and slag particles.

Factors in Life of Furnace

The silica roof, the ports, and the checkers generally are the determining factors in the life of a furnace, and of the three, the ports and the roof are most troublesome. While the customary American port design consisting of a long narrow, air port directly above a much smaller gas port produces a fast working furnace and allows better combustion without danger of burning the port at the out going end, the arch forming the gas port is subjected to high temperatures by the gas on one side and the air on the other, thus affording no opportunity for cooling. These conditions produce failure of the nozzle or end of the gas port and cause the flame to be thrown upon the walls and roof of the furnace.

To prevent local overheating and consequent failure of brickwork resulting from this lack of flame control, water-cooled, steel ports have been introduced. This type port is of the same general form as the ordinary brick arch port and is inserted through the end of the furnace, being protected by a permanent silica brick arch closely conforming to the outer shape of the metal port. In some cases the end of the brick arch is built of magnesite brick to withstand the action of slag splashes, although magnesite brick spall excessively at this position due to the water cooling. The ports are constructed so that the flow of gas and air should strike the level bath at a slight angle, and the intensely hot, radiant flame should pass through the furnace close to the bath and separated from the roof by a blanket of cooler air. However, during melting, the furnace is piled high with steel scrap, forming an excellent baffle from which the flame can be deflected strongly against the roof and side walls. Hot eddy currents are produced at the side walls, opposite the *spotting* point of the flame due to the swirling action given the gases by incoming air impinging sharly on the top of the gas flow if the furnace is slightly narrow. This causes a heavy corrosive action in the side of the roof and lower side walls, in some cases necessitating building a roof having a 9-inch center and 12-inch sides to prevent the entire roof from dropping.

Substitute Oil Fired Furnace

Frequently while repairs are being made on parts of the gas producers of a furnace designed to burn producer gas, an oil burner is inserted through a gas port. When a furnace of this type is operated on oil, the life often is reduced about 50 per cent due to the roof being much too low for the intense heat generated by the oil flame. If the roof is raised several feet, a fast working furnace is produced by oil firing and the flame action is distributed to all parts of the furnace instead of largely to the roof. The oil-fired furnace has a much shorter life than the gas furnace, but the increased production offsets the cost of rebuilding.

While the acid nature of the silica roof is unsuited to withstand the fluxing and scouring action of the gas, which is laden with abrading and fluxing particles, silica is used because of its relative cheapness and ability to withstand the excessive temperature, which frequently is in the region of 1700 degrees Cent. Silica brick are used, up to a point near the melting temperature, due to the property of withstanding the high pressure of the flat-arched roof. Also, the high heat conductivity of the brick allows the outer portion to remain firm and rigid even with the inner portion fused. In practice a silica roof is used until reduced to about 3 inches in thickness. On examination, the iron impregnated lower portion of a roof brick clearly shows the strong fluxing action of the iron and other basic oxides in the furnace gases.

Spalling of Refractories

The silica side walls are subjected to the direct slagging action of the highly corrosive basic slag at or near the slag level, in addition to the scouring and fluxing effect of the gases. The load carried is that of the wall itself, the weight of the roof being carried by a special steel framework built around the furnace. The brickwork is subjected to considerable thermal shock during charging and after tapping, especially near the doors, which are then wide open and admit large amounts of cold air. For this reason, magnesite and chrome have not been entirely satisfactory, due to their strong tendency to spall. The direct action of the slag is great and the lower portion of the side wall from a few inches above the slag line down, sometimes is made of a high-quality, chrome brick in preference to several courses of chrome separating a lower portion of magnesite from the upper portion of silica.

In the construction of 200-ton tilt-

From a paper presented at the Atlantic City, N. J., meeting of the American Ceramic society, Feb. 4-9. The author, Charles A. Smith, is connected with Lehigh university.

ing furnaces for the Talbot process, the basic lining necessarily must be carried up the side walls for a considerable distance to prevent slag action on the walls during tilting. Frequently, in this type of furnace, the wall on the tapping side is made entirely of magnesite. Since much of the metal is charged molten, and, therefore, quickly charged, and since repairing the bottom takes less time, due to the tilting action, the sudden cooling of the brickwork by air currents and spalling is reduced.

While the hearth is corroded by the slag, especially at the highly oxidized edges of the bath, it can be and is patched after every melt. Consequently the corrosive action is less important than in other parts of the furnace. However, the hearth must be highly resistant to abrasion and mechanical shock and must be capable of withstanding loads charged upon it. The structure must be dense and firm throughout the range of temperatures used, to prevent the absorption of metal and slag, which would lower its refractoriness.

Avoid Formation of Cracks

Formation of cracks resulting from mechanical shock are highly undesirable, since these allow a passage for metal to work down, which would permit large sections of the bottom to work loose and allow molten metal and slag to eat through the steel shell supporting the structure. The chief trouble with the hearth occurs in the formation of holes or depressions that may result from mechanical shock, thermal shock, or improper sintering.

Bulkheads may be termed that portion of the end of the hearth extending up to the gas port. Service conditions are different from those on the hearth, the corrosive action of the slag itself being accompanied by the scouring and fluxing action of particles in the exit gases, and in addition there is considerable direct flame action. Material is not charged in this portion of the furnace and, therefore, the mechanical shock is not important.

Uptakes and slag pockets leading from the gas and air ports to the regenerators generally are built of silica brick, even though the gases passing through them carry highly basic particles and flux the brickwork. Magnesite is not used extensively, due to spalling action resulting from the repeated heating and cooling during reversals. However, in some cases, it is used directly back of the ports in the top of the uptakes. Outgoing combustion gases may be at temperatures of 1500 to 1650 degrees Cent., while the preheated incoming air and gas, upon reversal, are from 1000 to 1100 degrees Cent. at the top of the uptake. Thus, the temperature, abrasion, and basic fluxing action are great throughout the uptakes and slag pockets. In addition to the reactions mentioned, the incoming gas in the gas flues is reducing in character, this attribute being important in a suitable refractory.

Changes Increase Service Period

Regenerators are used, not with the primary idea of saving heat, but to obtain a high flame temperature, that is a high difference of heat potential between the combustion gases and the furnace charge. Temperatures are such that fire clay brick can be used for the checkers. Waste gases enter the regenerator at from 1300 to 1500 degrees Cent. and leave at from 400 to 600 degrees Cent. Chief requirements of brick used as checkers are that they must absorb and give up heat readily, that they must not glaze, and in the gas checkers brick high in iron should not be used, due to the disruptive action of the carbon deposited by CO in the gas. Although properly designed slag pockets remove a large part of slag and flux particles from the gases, a considerable amount of dirt collects in the checker flues. Numbers of special flue designs have been tried with varying degrees of success. In a plant in which standard 4.5 x 4.5 x 10.5-inch brick checkers had to be cleaned after 145 heats, the same chamber filled with 5½-inch vertical flues using 13.5 x 6 x 2.5-inch shapes, lasted 1800 heats before cleaning and gave satisfactory heating service. Increased life was due to the shapes being laid on the 2.5-inch side and thus only this series of narrow edges was presented at the top of the checkerwork to collection flue dust.

Service conditions obviously must be of first importance in selecting refractories for various uses in a furnace, and many of the are known definitely. However, it must be remembered that it is difficult to determines the exact conditions of gas composition, temperature, and fluxing by fume and small slag particles, and not much exact information of this kind is available at present.

High-Carbon Steel Least Severe

Of the different grades of steel, high-carbon steel is least severe to the open hearth since the slag is neither as oxidiziing nor is the time as long as in a low-carbon steel process. Since the melting temperature and fluidity of a steel increases with the carbon content, the production of low-carbon steel requires either a furnace temperature several hundred degrees higher than the high-carbon steel process, or a much longer treatment, with greater wear and tear of the furnace resulting. If a charge of 75 per cent scrap and 25 per cent pig be melted down soft, thus producing an extremely corrosive slag and a heavy oxidation of the scrap, the slag corrosion resulting is severe, especially in the acid-hearth furnace. If an extremely active slag is not used, the time of the operation must be increased to remove the carbon, and the furnace wear and tear is increased correspondingly per heat. If a large quantity of pig iron is used, its quick oxidation by the ore added splashes more slag on the lining than when lower amounts of pig iron are used.

The practice of carrying at all times 0.15 per cent silicon and 0.20 to 0.40 per cent manganese as residual silicon and manganese in the bath to keep oxygen out of the final steel removes the oxidizing layer of the bath between the metal proper and the slag, decreasing the corrosive action at the shallow edges of the bath.

In the final analysis, the refractory which is most desirable from the steelmaker's point of view is that which will enable him to produce steel at the lowest furnace cost per ton. If by frequent renewals of lining at a fairly low price, a fast working furnace will give a production large enough to offset the cost of new lining that operation is satisfactory. If a higher priced refractory will permit the furnace production to be increased sufficiently to result in a lower or equal furnace cost per ton of steel, that refractory is desirable.

Builds New Plant

The Florida Machine Works, Jacksonville, Fla., recently constructed four buildings into which the present foundry will be moved. An electric furnace for melting steel for producing steel castings will be installed. The company will continue to produce gray iron, brass and aluminum castings, in addition to the steel line. One of the four new buildings will be used as a foundry, one as a machine shop, one as a warehouse and the fourth as a pattern shop and storage. F. G. Russell is proprietor.

Sullivan Machinery Co., Chicago, has removed its office in Birmingham, Ala., to 2108 Fifth avenue north. G. P. Small is state manager.

Make Heavy Machine Parts-I

Methods, Appliances, Floor Space and Mechanical Equipment on a Huge and Prodigal Scale Are Required to Handle Castings for Sugar Mills, Rubber Factories and Paper Mills

BY PAT DWYER

IN COMMON with many things connected with the arts and sciences, with manufacturing processes, and with discoveries later claimed by others, the Chinese are credited with having been familiar with sugar as far back as 600 A. D. Knowledge of the material gradually spread to Europe and eventually to America, but its preparation was exceedingly limited and the methods and apparatus employed in the industry were crude and primitive in character. The first attempt to make sugar on a commercial scale was in 1794 on a Louisiana plantation, at that time merely a cultivated area near the Mississippi river, but now and for many years past the South's greatest commercial center and one of the five great ocean ports of this country, New Orleans. The first sugar mills were operated by water, by wind mills or by oxen attached to a circular sweep and real progress did not begin until after the introduction of the steam engine in the first quarter of the nineteenth century. The growth of the industry may be gaged from the fact that in 1894 or about 100 years after the erection of the first mill, the sugar production of the southern states totalled considerably over 300,000 long tons and that of all sugar producing countries almost 6,000,000 tons.

Many factors are responsible for this increase and certainly not the least is the development of cane crushing mills and other mechanical devices employed in the industry to their present high degree of efficiency. Eminent engineers have worked toward increased efficiency and economy and then have discovered that on account of the character of the service and the severe operating conditions involved comparatively few manufacturers were inclined to bid on sugar machinery contracts. One of the first to engage in the business of supplying this special class of machinery was the Farrel Foundry & Machine Co., Ansonia, Conn., established by the late president Franklin Farrel in 1848.

In the early days of the business, the principal products were rolls, gears, and other machinery incident to water driven brass mills in the Naugatuck valley. This branch of the business never has been relinquished but has been expanded to a degree that embraces complete rolling mill units and rolls for all purposes, sand and chilled and of practically any dimension to meet customer's specifications. The first sugar mills were built by the company in the early seventies for Cuban plantations and since that time mills have been shipped to practically every country in the world where sugar cane is cultivated.

A plant and equipment designed and capable of handling this kind of machinery naturally attracted the attention of the pioneers engaged in the early development of machinery for the paper and rubber industry; the same is true of crushing and grinding machinery and while today a considerable tonnage of miscellaneous castings is made, the greater part of the output may be grouped under the four foregoing classes.

The Ansonia plant covers an area of 13½ acres and in addition to foundry embraces an extensive roll finishing shop, machine and erection shops, pattern shop, power house, pattern storage and general offices. During the

FIG. 1—FOUR CUPOLAS RANGING FROM 48 TO 72 INCHES INSIDE DIAMETER ARE CHARGED FROM THE SAME PLATFORM—ONE IS CHARGED BY HAND AND THE OTHER THREE ARE CHARGED MECHANICALLY—THE CHAIN BLOCK SHOWN SUSPENDED BY EACH CUPOLA IS EMPLOYED IN PULLING UP THE DOORS IN THE MORNING

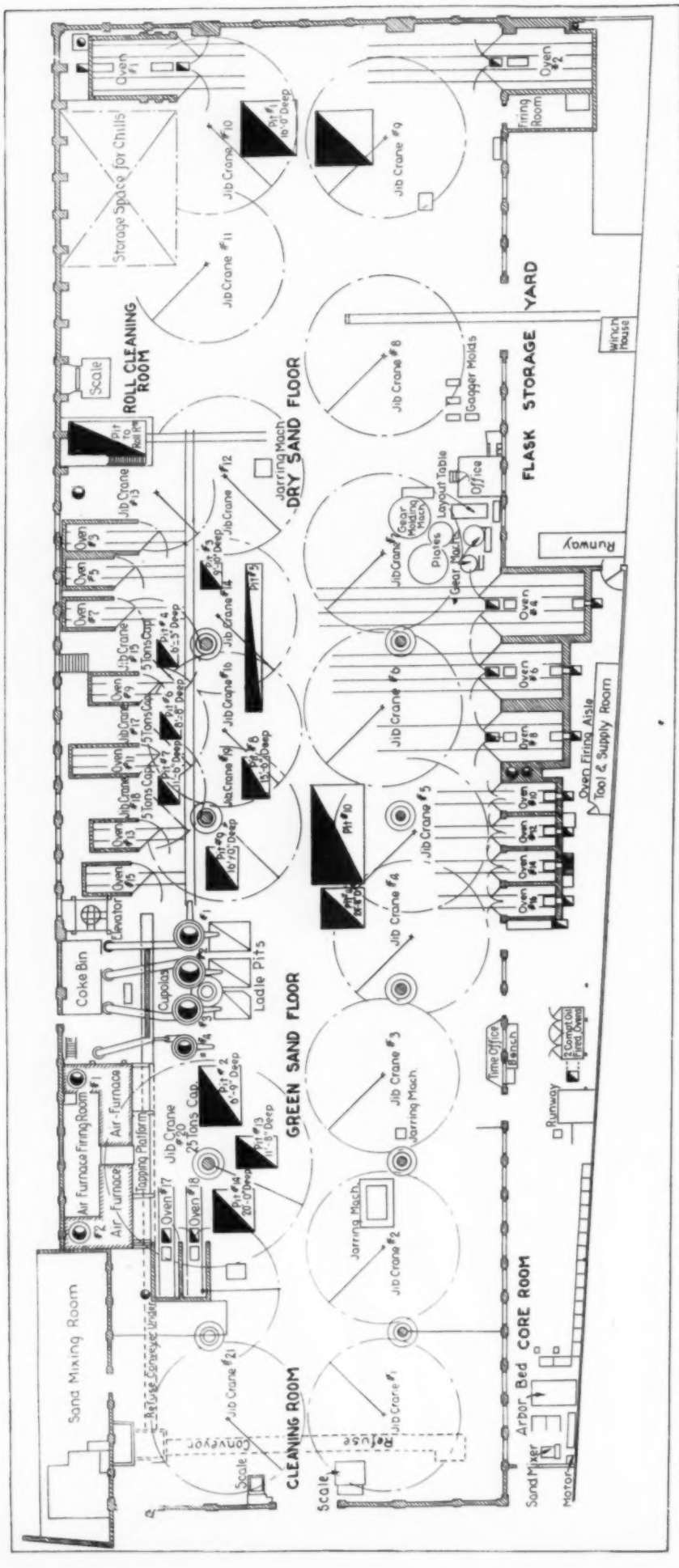


FIG. 2—FLOOR PLAN OF FOUNDRY SHOWING LOCATION OF VARIOUS DEPARTMENTS, COLUMNS, MOLDING MACHINES, OVENS, PITS AND MELTING FURNACES

war period the company acquired a large machine and erection plant in Buffalo which still is operated and more recently a foundry was taken over in Seymour, Conn., where many of the small castings, formerly made in one section of the parent foundry now are made. In the present article only the Ansonia foundry will be considered.

The general arrangement of the foundry floor, casting pits, cranes, cupolas, ovens, air furnaces, sand mixing and cleaning room are shown in Fig. 2 and the layout will indicate that the castings and molds are of an exceptionally heavy character.

Crane Capacity Large

The main bay of the foundry is served by five electric traveling cranes; one 30-ton made by the Morgan Engineering Co., Alliance, O., two 30-ton with 15-ton auxiliary made by the Shaw Crane Co., Muskegon, Mich., one 30-ton with 15-ton auxiliary made by the Alliance Machine Co., Alliance, O., and one 30-ton with 15-ton auxiliary made by Pawling & Harnischfeger Co., Milwaukee. A 15-ton traveling crane with 5-ton auxiliary hoist made by the Shaw Crane Co., serves the end of one of the side bays where the rolls are cleaned preparatory to transferring them to the roll finishing shop. In all 21 jib cranes are distributed in such a manner as to cover practically all the floor area. These cranes have a uniform lifting capacity of 10 tons with the exception of three over the small roll pits in one of the side bays and a fourth crane of 25 tons capacity which serves three large roll pits in front of the two air furnaces. Four jib cranes are driven electrically, the remainder are belt driven from a line shaft through suitable gearing and clutches.

A large proportion of the crane capacity is required in roll production which involves handling the chills and flasks in assembling the molds. These castings are made either from air furnace or cupola iron depending on the purpose for which they are intended. Rolls are cast in practically every size up to and including some that are 226 inches long on the face, others 6 feet in diameter and weighing about 40 tons. Other iron and semisteel castings recently completed include an engine bed of 44 tons and a bed for a crusher that weighed 55 tons when cleaned.

The steel frame, brick building is 426 feet long, 126 feet wide at one end and 112 feet 5 inches wide at the other end. The columns which support the crane runway are approxi-

mately 50 feet apart. It will be noted by referring to Fig. 2 that the jib cranes on both sides of the main bay are located in such a manner that they can handle loads either in the main bay or on that part of the floor between the columns and the wall of the building.

One of the outstanding features in this foundry is the manner in which daylight is diffused over the entire floor from continuous skylights on both sides of the roof and extending from one end of the building to the other. Daylight is a valuable asset at any time in any foundry, but particularly in a shop where a great many molds are made partly or wholly below the floor level. That this shop is amply lighted is illustrated in Fig. 3 where the mold is over 6 feet deep. In addition it will be noted from Fig. 2 that the numerous roll pits are deep, ranging from 6 feet 3 inches to 24 feet 4 inches.

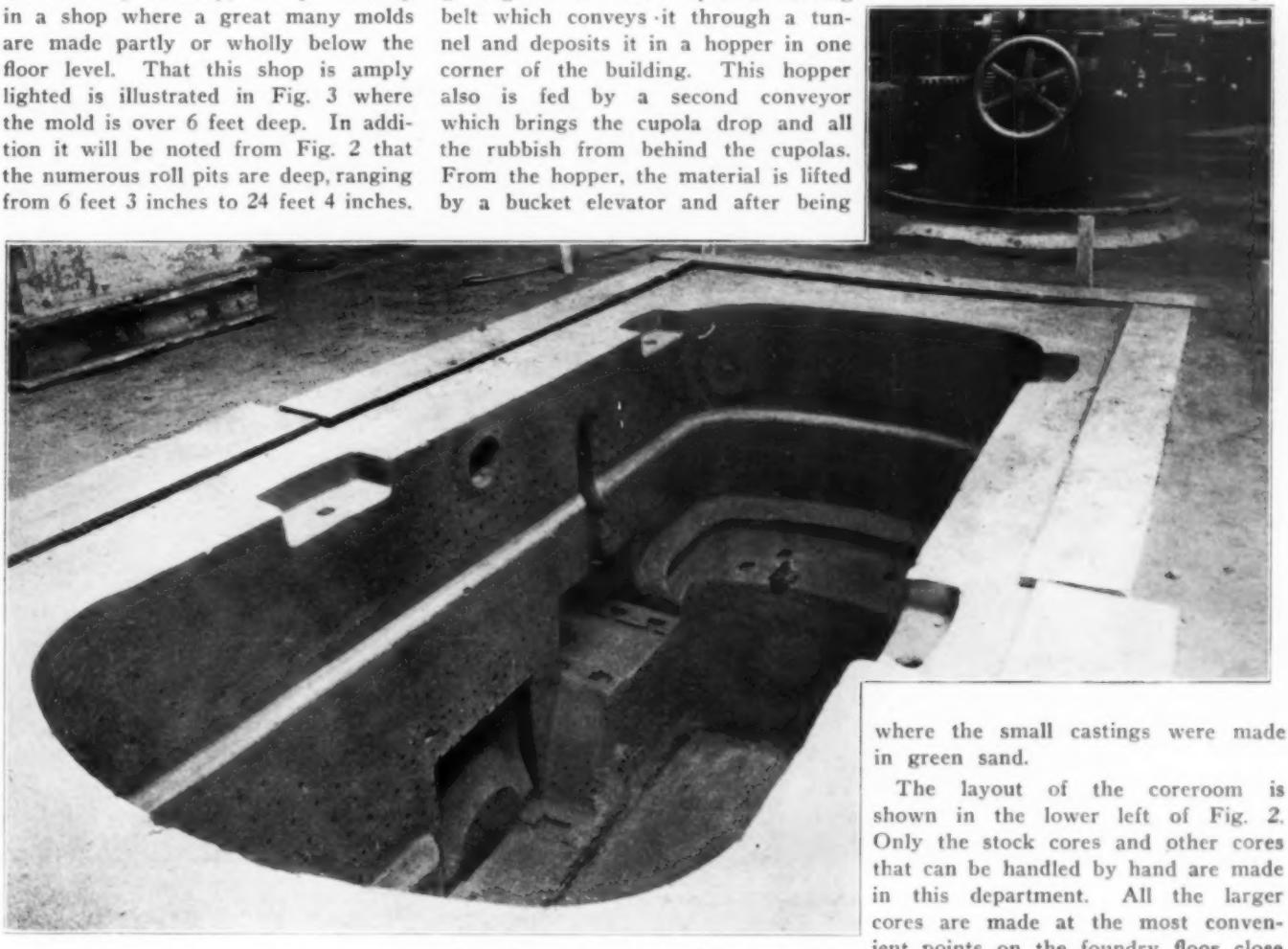


FIG. 3—LARGE CRUSHER BEDS AND OTHER CASTINGS OF A SOMEWHAT SIMILAR CHARACTER ARE MADE IN MOLDS THAT ARE DRIED IN THE FLOOR

The advantage of direct overhead daylight while setting cores or assembling chills so far below the floor surface is apparent.

In general, it may be stated that the available molding space is about equally divided between that devoted to green sand and to dry sand work. Perhaps the readiest means of gaining an intelligent conception of the interior arrangement of the foundry is to enter in imagination the large doorway in the cleaning room end of the building and consider each feature individually as it is shown in the illustration Fig. 2.

The cleaning room extends across the end of the building and occupies all the space between the end wall and the first pair of columns. In addition to the overhead traveling crane, it is served by two jib cranes situated in such a manner that they can handle a load over practically any part of the floor. Two scales are provided for weighing the castings, one under the sweep of each crane. All the refuse and burned sand cleaned from the castings is shoveled through suitable gratings in the floor upon a moving belt which conveys it through a tunnel and deposits it in a hopper in one corner of the building. This hopper also is fed by a second conveyor which brings the cupola drop and all the rubbish from behind the cupolas. From the hopper, the material is lifted by a bucket elevator and after being screened and separated and having all scrap removed it is discharged into a hopper outside the building. This hopper is provided with a discharge spout and gate and is suspended in such a manner that a truck may be spotted underneath to receive the material directly and haul it away to the dump.

A wide central concrete gangway is maintained clear and open from one end of the foundry to the other and while it does not serve as a dividing line between departments it does serve to maintain a certain orderliness in the disposition of various parts of molds and other foundry equipment. Many of the green sand molds are made on a pair of plain jar-ram molding machines, one made by the Tabor Manufacturing Co., Philadelphia, and the others by the American Molding Machine Co., Terre Haute, Ind. Others are rammed in flasks by hand or bedded in the floor after the manner usually employed in jobbing shops. The coreroom is housed in a building adjoining the foundry building and formerly was known as the dog house where the small castings were made in green sand.

The layout of the coreroom is shown in the lower left of Fig. 2. Only the stock cores and other cores that can be handled by hand are made in this department. All the larger cores are made at the most convenient points on the foundry floor close to the ovens in which they are to be dried. The cores are made from a sharp sand procured near Providence, R. I., bonded with a proprietary oil binder and mixed in a paddle-type mixer made by the Blystone Mfg. Co., Cambridge Springs, Pa. The stock cores are made in one of the first machines made by the Wadswoth Core Machine & Equipment Co., Akron, O. Some of the dies have worn out in long service, but the machine itself is still in service. The small cores are dried in two oil-fired ovens and also in a third shelf oven attached to the outer wall of a long battery of car ovens provided with doors open-

ing into the foundry. A permanent arbor bed is maintained in the coreroom where a helper may prepare the cast-iron arbors for the larger cores. This style of arbor is used wherever possible in preference to rods or pipes.

The continuous battery of four core and three mold ovens shown in the lower center of Fig. 2 is located outside one of the side walls of the foundry about midway from each end of the building. The ovens come under the roof of the coreroom, but the doors are in line with the foundry wall and swing outward toward the molding floors when opened. The core ovens, 8½ x 16 feet each, are heated individually by a single coke fire located below the floor level at the back of the ovens. The mold ovens, 17½ x 14 feet; 17½ x 16 feet; 24 x 17½ feet are each provided with two coke fire places, one at the center at each end. Draft for the two groups of ovens is provided by two stacks located in the space between the core and mold ovens. The tracks from the core ovens only extend to a point where the loads on the cars may be handled by a jib crane erected close to one of the columns supporting the traveling crane runway over the main bay of the foundry. The tracks from the mold ovens extend to a point where they may be loaded and unloaded either by one of three jib cranes or by the overhead traveling cranes.

A chain attached to the car is employed for hauling the loaded cars in and out of the ovens. A channel is provided between the tracks to prevent the moving chain from coming in contact with men or molds and the end of the chain is reeved through a sheave anchored to a deadman in the floor. The crane is attached to the chain and employed for pulling the cars either way. Various types of cars have been tried at times in the mold and core ovens and it is claimed that the construction shown in Fig. 4 is the most satisfactory. It is provided with three pairs of wheels mounted in roller bearings and moves so easily when empty that a single man can push it along the track.

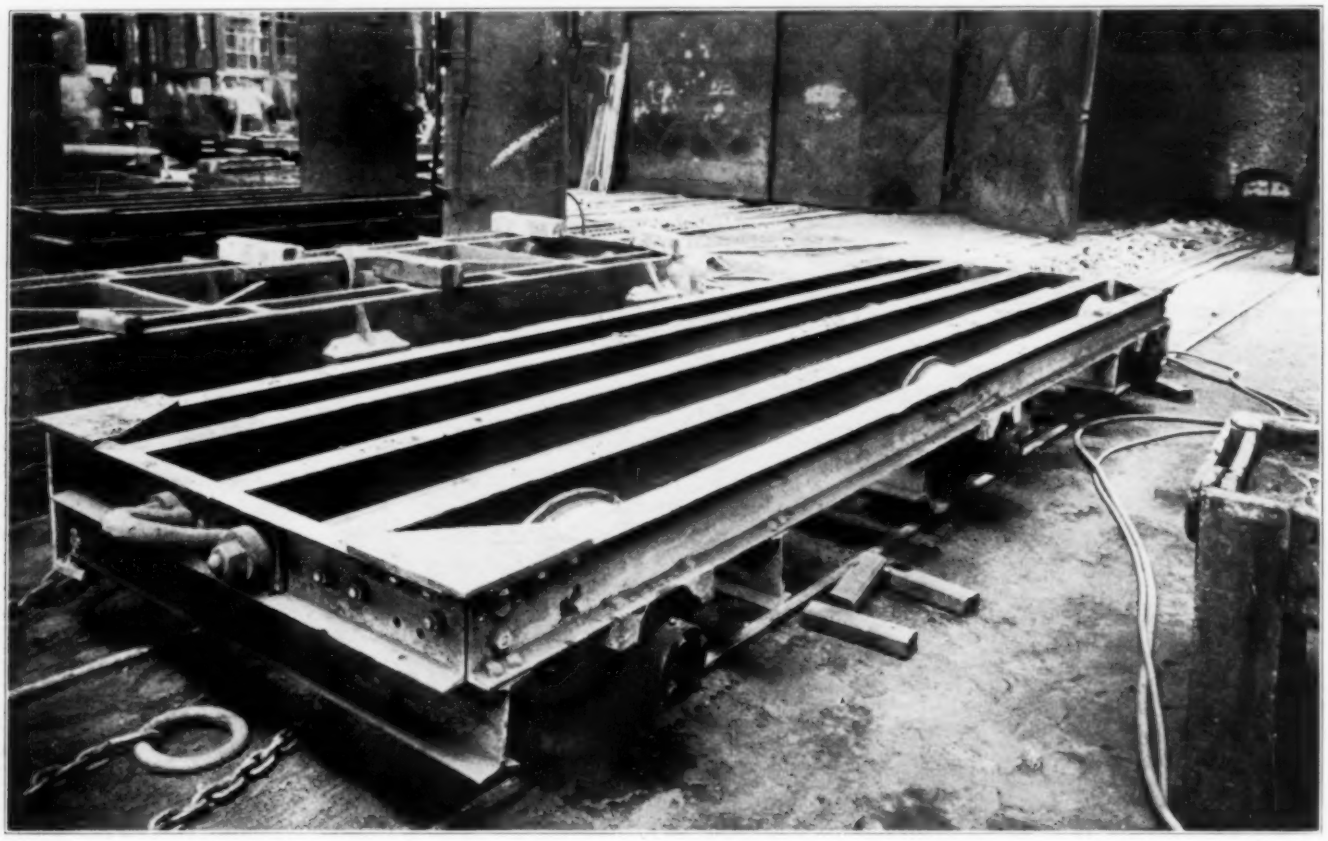


FIG. 4—THIS CAR IS PROVIDED WITH ROLLER BEARING WHEELS AND CAN BE MOVED WITH A MINIMUM OF EFFORT—THE HANDLE AT EACH END IS ATTACHED TO TWO RODS WHICH RELIEVE THE FRAME FROM DISTORTION STRAINS WHEN A LOADED CAR IS PULLED IN EITHER DIRECTION

Making Gear Wheels

Gear wheels and pinions of practically every shape and size, spur and bevel, single, double, staggered, worm and helical enter extensively into all the machinery manufactured in this plant. Some of the wheels are cast as blanks in which the teeth afterward are cut, but a large proportion are cast with the teeth in place. Accuracy of product is assured by molding the wheels in iron flasks on which the joints have been machined. The drags are rammed on three machines graded in size to handle wheels from the smallest up to 25 feet diameter.

Gear molding machines are employed in relatively few foundries and for the benefit of those who may not be familiar with their operation it may be stated that their only function is to space the teeth accurately on a true circle of any given diameter. The only pattern equipment required is a block containing two teeth, a profile straightedge to sweep a bed in the drag and a corebox to form the arms. The drags either are skin dried or completely dried. The arm cores sometimes are dried and at other times are placed in the mold green. Procedure depends on several factors the principal one being the size and weight of the wheel.

Gear wheels are poured from a semi-steel mixture ranging from 15 to 25 per cent steel. Copes and arm cores for the wheels are rammed on two circular plates set flush with the floor in the vicinity of the gear machines and machined to a true plane on the working face. The gear floor is served by a jib crane and also projects far

enough into the main bay of the foundry to be served by the traveling cranes.

A car running back and forth on a transfer track a short distance beyond the gear floor and extending from the center of the main bay to a point almost on the far side of the flask yard, serves to convey the empty flasks into and out of the foundry. Power to operate the car is supplied by an electrically driven winch. A large twelve-ton derrick is used to load and unload flasks in the flask yard.

Two ovens, each approximately 17 x 25 feet are located at one end of the foundry in opposite corners. Each oven is fired at both ends and is employed in drying either cores or molds. The latter usually are cast in the two pits in the floor of the main bay at that end of the foundry. The deeper pit usually is utilized for casting molds for railway crane masts and other castings of a somewhat similar character that require dry sand molds made in lofty flasks. Molds for heavy crusher beds and other castings that lend themselves to the method are molded, dried and cast in the floor inside the second pit as shown in Fig. 3. In this instance the cast-iron walls of the pit serve as a curb to prevent distortion of the mold walls under the pressure of the molten iron.

It will be noted that each of these pits is served by a jib crane capable of handling patterns, flasks, cores, etc. However, they also are located in such a manner that the traveling crane can bring iron directly from the furnace to pour the molds and also may be utilized to strip the castings and convey them to the chipping room. The mold in the illustration is gated at both sides of the bottom on the end that is not visible in the illustration. Some of these patterns are the exact duplicates of the castings and the sand forming the interior of the mold is lifted out on a plate and afterward dried in the oven before it is returned to place. In others the pattern only serves to make the exterior of the mold, the interior is formed by a dry sand core formed in a regular corebox.

FIG. 5—THE LONG GALLERY IN WHICH THE CHARGES ARE ASSEMBLED IS SERVED BY THREE TRACKS ON THE FLOOR AND THREE MONORAIL TRACKS OVERHEAD WHICH SUPPORT TWO 5-TON HOISTS—THE MONORAILS EXTEND FROM THE ELEVATOR TO THE CUPOLAS AND ARE PROVIDED WITH SWITCHES BY WHICH THE LOADS MAY BE DIRECTED TO ANY OF THE CUPOLAS

Chilled Rolls Cast in Pits

Large and small chilled rolls are cast in the pits on the same side of the center gangway as the cupolas. The top and bottom section of the mold containing the neck and wabbler is formed in a dry sand mold and the metal enters the bottom neck through a gate which imparts a whirling motion. The upright runner is erected independently on the outside of the chills. It is attached to a suitable pocket on the flask section on the bottom of the mold and is provided on the top with a tapered, rectangular pouring basin into which the metal is poured rapidly.

The upper and lower sections on sand rolls are made in a manner similar to that method employed in molding chilled rolls and the molds are gated and poured in the same fashion. The body of the roll is formed in a dry sand mold in a number of round iron flasks. The number of flask rings will depend on the length of the roll. Rolls for rubber factories and others for certain purposes are cored throughout their entire length and require the most careful treatment in making the mold and core to prevent the least disturbance during the pouring. The metal is melted hot and poured rapidly to insure a perfectly smooth clean surface on the casting when it is ground and polished in the finishing shop.

The roll castings are cleaned in the space indicated at the upper right in Fig. 2. Part of this space is utilized for storing the large number

of chill castings that are not in use on any given day. In addition to their legitimate use, many of the chills are employed as weights on molds in various parts of the foundry and also for other purposes. After the rolls are cleaned and weighed they are lowered into a pit provided with a track and transfer car which conveys them into the roll grinding department located on a lower level than the foundry floor.

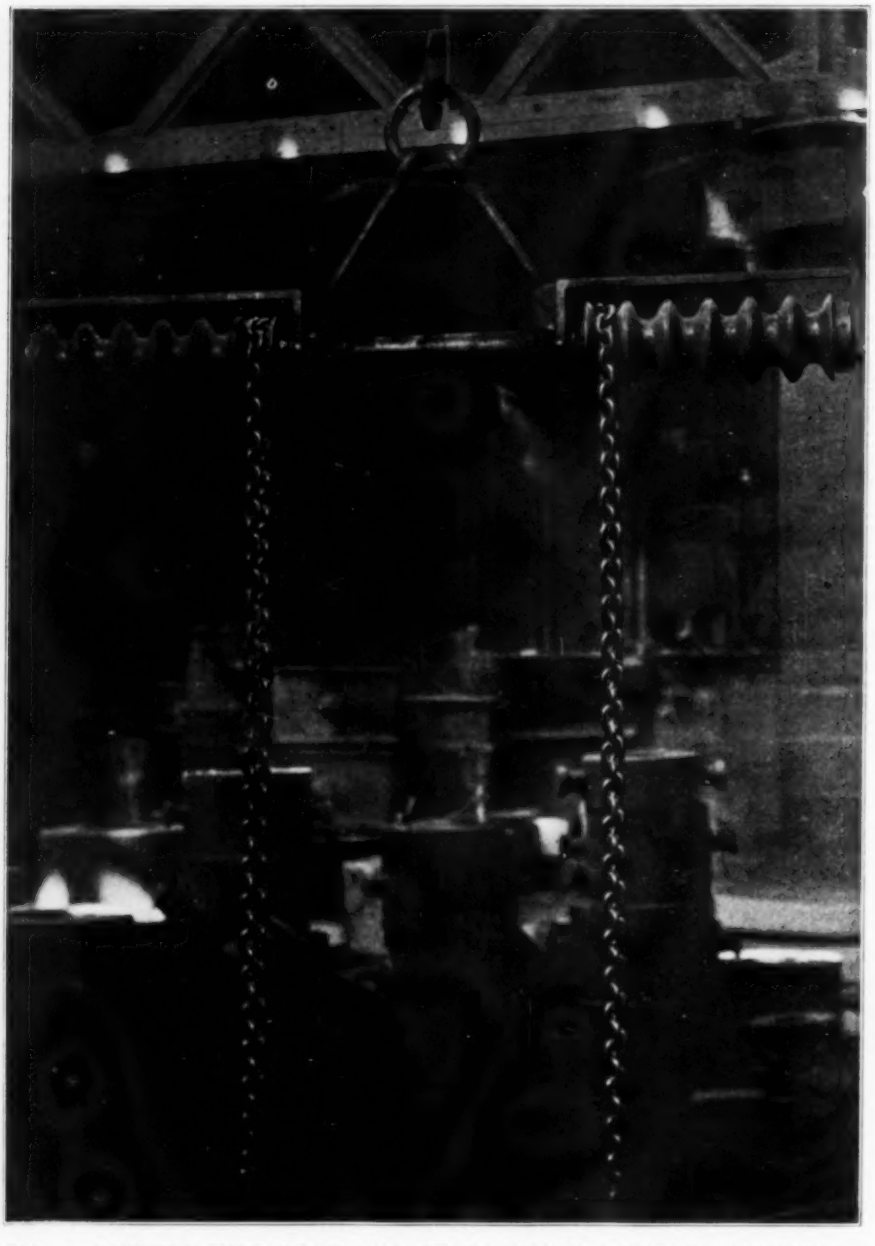


FIG. 6—ROLLING TYPE BEAM AND CHAIN SLINGS PRESENTS ADVANTAGES OVER THE USUAL RIGID BEAM AND LOOP SLINGS

Under normal conditions the foundry has a melting capacity of 120 tons a day from four cupolas and two air furnaces. The air furnaces have a melting capacity of 15 tons each and the cupolas made by the Whiting Corp., Harvey, Ill., are lined respectively to 72, 66, 60 and 48 inches. An individual motor-gear driven blower is provided for each cupola. Three blowers were supplied by the P. H. & F. M. Roots Co., Connersville, Ind., and the other by the Wilbreham-Greene Co., Philadelphia. The 48-inch cupola is charged by hand. The others are charged mechanically as shown in Fig. 1, by pneumatic tipping devices located below the charging floor. The loaded car is lowered from the monorail to the tipping platform. The operator steps on a rod projecting above the floor. This rod controls the valve on the air cylinder. When the rod is pushed down, air is admitted to the cyinder and as a result the plunger from the cylinder elevates the back of the charging car and spills the contents through the open end into the cupola. When the operator removes his foot air is exhausted from the cylinder and the car sinks back to a horizontal position. It then is pushed out of the way and replaced with a loaded car.

Peculiar conditions incident to the relative position of the foundry and the stockyard are responsible for the long elevated gallery shown in Fig. 5 through which all the iron, coke, limestone, sand and coal are carried into the foundry. This gallery, 262 feet long, extends from the charging floor of the cupolas, over several buildings and railroad tracks and terminates in two elevators served by tracks leading to the various stock piles. The gallery is equipped with three tracks on the floor, two for loaded cars and one for empties; with two monorails suspended from the roof beams and provided with switches at suitable distances for the convenient manipulation of two 5-ton hoists made by the Shaw Crane Co., Muskegon, Mich.

Distributing Material

Coke for the numerous core ovens is brought in through the gallery and then dumped through a chute into a large bin on the foundry floor back of the cupolas. Coal for the air furnaces is brought in as far as the charging platform in the same manner and then deflected to a side track which leads to chutes discharging over the furnace firing floor. Sand is conveyed over a continuation of the same track and dumped in the sand mixing department.

The stock yard which covers an area of 1½ acres is served by four spurs from the main line of the New York, New Haven & Hartford railroad, one leading to the coal, coke and sand storage sheds; one to the iron yard; one to the roll shop and one to the erecting shop. The iron yard is provided with a circular track and equipped with three electric traveling cranes, two of 15-tons and one of 5-ton capacity. The proper mixtures for the various castings and also the order in which these mixtures are to be poured are predetermined in a well equipped laboratory and an order to this effect is made out in triplicate. One copy goes to the yard boss, one copy to the man on the charging floor, and one copy is retained in the office. The various piles of pig iron and scrap are labeled in a simplified manner and the cars are loaded and sent up the elevator leading to the long gallery in the order on which they are indicated on the charging slip from the laboratory.

The air furnace was installed many years ago to provide a means of melting

(*Concluded on Page* 199)

Humanizing Brass Foundries

Unattractive Features Often Serve To Deter Men From Taking Up Brass Casting Work—Eliminating Noise and Fumes Suggested—Progress Makes for Better Production

BY CHARLES VICKERS

PROGRESS, the dictionary informs us, means moving or going forward toward a state of completion, or perfection. Applying the word in an inquiring manner to the business of brass founding, it may be shown that progress has been made, but whether it is considered entirely satisfactory will depend largely upon the individual point of view. Progress may be made in a number of directions in the manufacture of castings. Thus, it may go in the direction of obtaining a greater number of castings, per man per hour. It may mean the production of better, or more perfect castings. Or it may follow the direction of a betterment of the conditions under which work is done.

Aim for Greater Output

Theoretically, progress should proceed simultaneously in all three directions, but a survey of the brass foundry industry as a whole, indicates that it has failed to do so. While some progress has been made in all three directions it has been far greater toward getting a greater output, than along either of the other lanes. It is doubtful if there has been great progress toward perfection of product. In fact, it may be said that increased production and better castings are incompatible, and that they do not go together. Whether this is true or not, it is certain they will not go hand-in-hand, unless the methods adopted for obtaining greater output have been carefully planned. Up to the present, mechanical appliances have been introduced, and new methods of doing the work adopted, largely with the idea of conserving manpower, and to obtain a greater production of castings than has been possible previously. This has been made necessary by the immensely increased demand for castings, brought about as a result of the wonderful progress toward higher standards of living within recent years. This improvement, or change in the manner of living has left a heavy imprint on foundry practice and has been a great stimulus toward the invention and adoption of mechanical appliances for carrying on the work. In fact, the widely extended use of power machines and methods for increasing production, may be said to be equally due to the changed ideas regarding living standards, and the increased demand for castings, due to the advent of the mechanical age we have entered upon.

This increased demand for the product of the brass foundry has created a demand for more skilled artisans to carry on the work, and these are not forthcoming for several reasons. Skilled workmen are not made to order. They are a product of experience coupled with adaptability and it requires time to produce them. The only thing that could be done was to subdivide the work, and simplify it as much as possible, then *break* in men to do the labor who were only expected to learn operations that are comparatively simple. This has been done and has resulted in greatly increased production in the case of certain classes of castings.

Chased By Dirt

Other reasons for a scarcity of skilled workers are found in the foundry itself. It is dirty, and the modern tendency is to avoid dirt of all kinds. No only is the foundry a dirty place, but the work itself is arduous. At some periods of the year, the shop may be uncomfortably warm, or uncomfortably cold, and in addition to such physical discomforts others are caused by the presence of harmful gases in the atmosphere, coupled with nerve-racking noises from the furnaces, or the cleaning operations. Under such conditions it cannot be expected that the native born and educated youth will voluntarily select the foundry as a means of livelihood. In fact, after a consideration of present conditions, how many foundrymen could truthfully say that if it were possible for them to

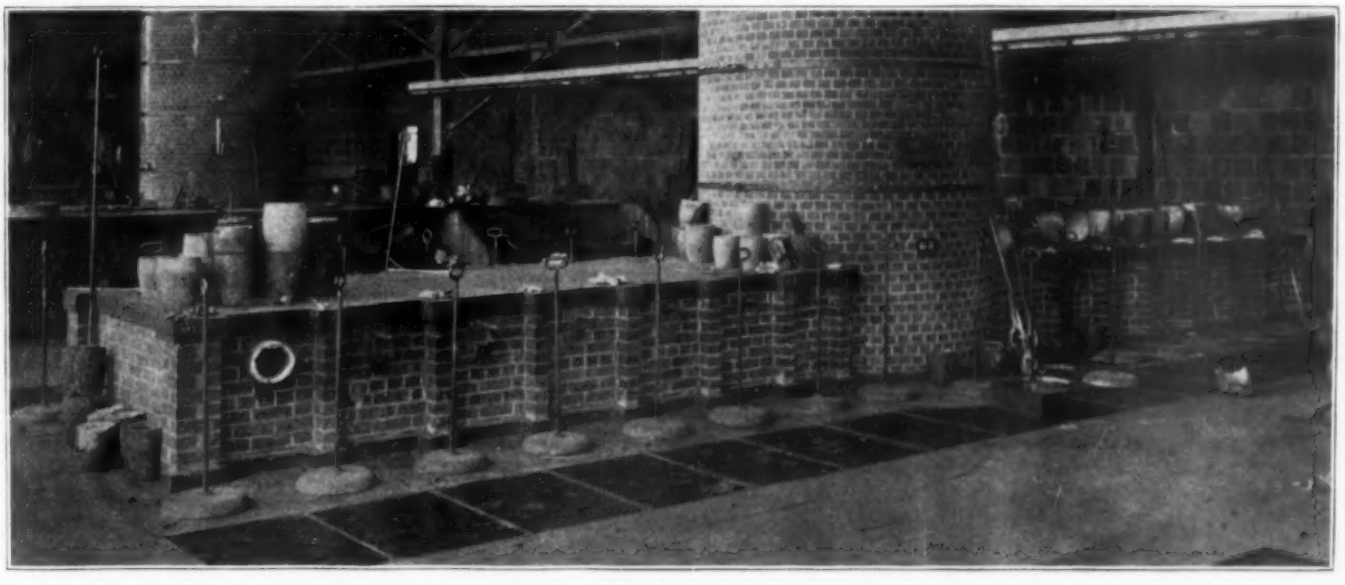


FIG. 1—CLEAN OPEN SPACE BEFORE THE FURNACES CONSTITUTES AN IDEAL CONDITION, EASILY OBTAINED, WHERE THOUGHT IS DEVOTED TO LAYOUT AND MAINTENANCE

begin all over again, they would a second time select the foundry?

The result of such conditions is that foundry workers are recruited largely from new arrivals in this country, a class that will take any work for a time. These people are not always ignorant. They fall into the foundry for awhile, but leave again as quickly as they become acclimated. This makes for a large labor turnover, which is costly as each new man has to be educated to the work he is expected to do. So long as such men can be obtained the situation is not measure of prosperity will be theirs and life there will become so much more desirable, that people will cease to leave their homes to journey to foreign lands. In view of the possibility of such changes, the question arises, how can the brass foundry be improved as a place in which to work?

One change that suggests itself immediately as an improvement is to departmentalize the brass foundry. Instead of putting all the operations involved in producing castings under one roof, they could be segregated. No difficulty need be anticipated through lows. This is true at least in Great Britain.

What was an advantage half a century ago, in days when noiseless and practically fumeless, solid-fuel heated, natural draft, melting furnaces were used exclusively, has become a necessity in these days of oil-fired and gas-fired furnaces with their deafening clamor. It is a mistake to place such equipment in the same room with the molders, not only because of their effect on the nervous organization and health of the workers in the molding room, but from the purely selfish

FIG. 2—DIRT OR CINDER FLOORS WITH IRREGULARITY IN GRATINGS BEFORE THE FURNACES CONSTITUTE A MENACE TO THE SAFETY OF WORKMEN EMPLOYED

without remedy. However, it is possible and indeed probable, that the time will arrive when this stream of immigrants may be dammed at its source to a mere trickle. This may not result from laws and edicts, but through the operation of natural laws. When such a time comes, the foundry industry will be forced to look largely to the native born, but it will look in vain if working conditions do not progress to the level of those which prevail in other lines of endeavor. It is just possible it will be necessary to out-top other businesses to offset some of the disadvantages under the foundry probably always will labor, such as handling molten metal.

A shortage of foreign help will confront the industry some time. The newly-carved out countries of Europe will some time find a solution to their problems. They are progressing toward that end now, and in time a this arrangement, and when new foundries are planned, means for segregating the distinct operations should receive serious consideration. This idea of separating the various distinct operations is new. Walter Graham in the seventh edition of his Brassfounder's Manual published in 1887, advocates the same plan. Thus, he states "It is common to have both molding and casting shops in one, and for a small works the plan is well enough; but where a dozen molders are employed, it is better to divide the work and separate the shops."

In 1887, and earlier, for the first edition probably made the same statement, the work was almost entirely done by hand. Indeed, stripping plate molding machines were known and were similar to those of today, but they were used to a limited extent as the molders willing to operate them were cordially detested by their fel- standpoint of greater returns. Men subjected to intolerable noise, and breathing dizzying fumes never should be expected to work to as good advantage as if free from such annoyances. It is hardly possible to have the molding room noiseless, or always free of fumes, but the whir of vigrators and other noises incidental to mold making, is as nothing compared with the reverberating booming of oil or gas-fired furnaces, which renders conversation impossible without straining the vocal chords. Although the molders may have little time for talking, it is necessary for those in charge to give instructions, which should be heard and understood, otherwise costly mistakes may occur.

When furnaces and molding room are all in one, and oil or gas-fired furnaces are used, in spite of ventilator hoods, the shop will contain fumes and gases sufficient to make it neces-

sary to have parts of the roof open continually. It is difficult to heat such places effectively, and in the endeavor to do so, much fuel is wasted in winter. In days of yore, the furnaces were expected to heat the shop in winter. These were aided by coke-burning salamanders placed here and there, which poured out into the room a continual stream of sulphur dioxide, as well as the usual gases of combustion. Everybody in the shop at some time or other had to go home, sick with a splitting headache. The winter was indeed a time to be dreaded. It was not at all uncommon for

would interfere with window space. If located midway of the molding shop as an enclosed section, it would render it more difficult to route the castings straight through the shop to the cleaning and shipping rooms. On the other hand it would serve to segregate aluminum from brass molding. All things considered, the best location for furnaces in large shops would appear to be at one end of the molding room with metal receiving and storage as a two-story side extension. The mixture weighing could be handled in the upper story which has elevator connection with the metal storage,

assists this more than to put a good, solid floor around them, and to install such is money well spent in the prevention of accidents alone. What may be called an ideally neat arrangement of furnaces is shown in Fig. 1 which illustrates one of the batteries of 36 natural draft furnaces installed by Yale & Towne Mfg. Co., Stamford, Conn. Natural draft furnaces may be easier to keep neat than oil or gas-fired furnaces, but there is no reason why the vicinity of such furnaces should be in the condition shown in Fig. 2.

The latter illustration shows a dirt floor around the furnaces which has

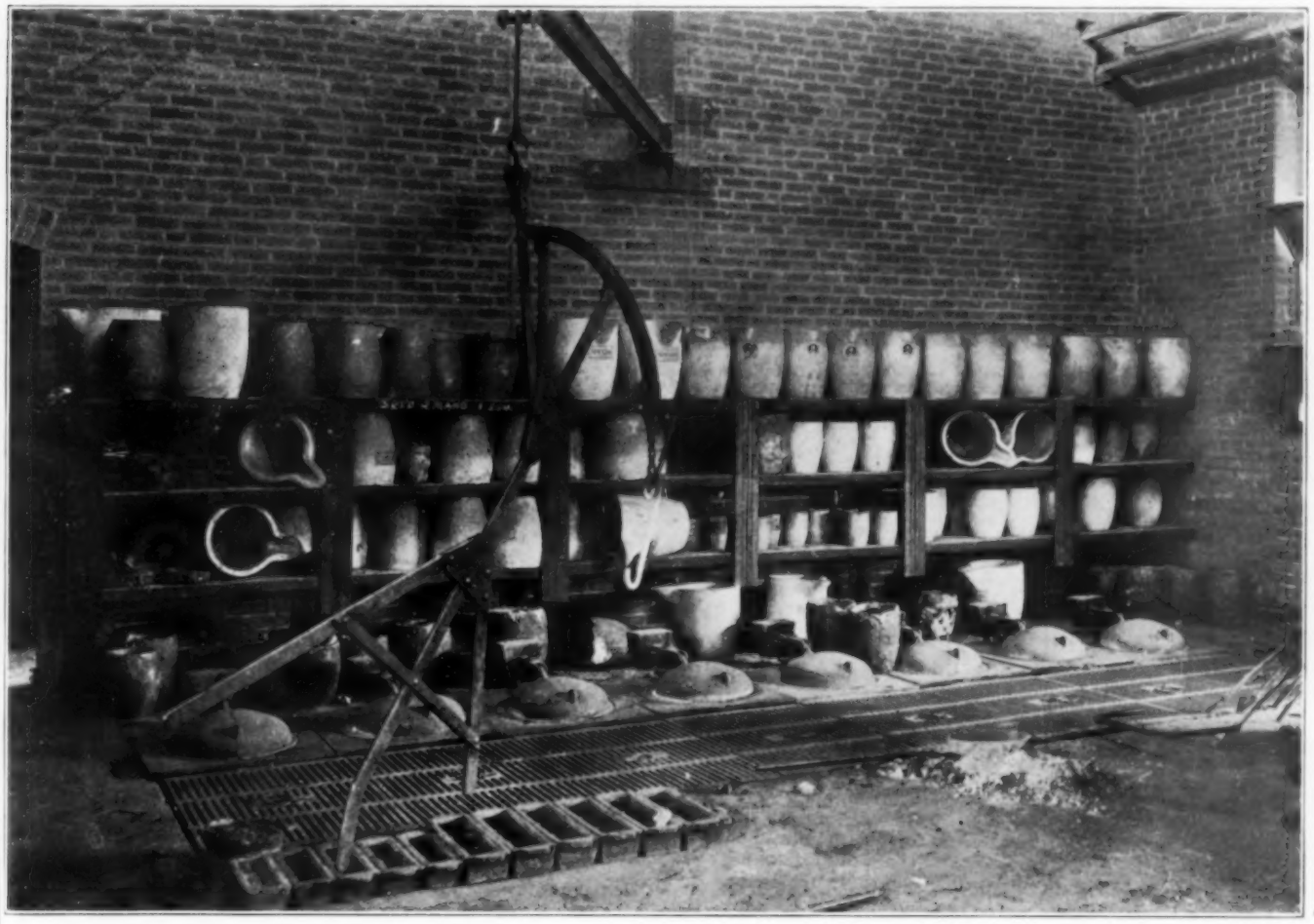


FIG. 3—EASILY OPERATED PIT COVERS, A FIRM GRATING AND ACCESSIBILITY CONSTITUTE THIS AN IDEAL FURNACE ARRANGEMENT—NOTE CONVENIENCE OF CRUCIBLE STORAGE

men to work on molds the sand of which froze under the tools. This is neither necessary or good business, and it is pleasant to note that considerable progress has been made toward eliminating such conditions, but foundries must continue to progress for perfection is a long way off.

Discarding the idea that it is necessary to locate the melting furnaces in the molding room to have them near the molding floors, and deciding to locate them in a separate room, where, it may be asked, should this room be located in relation to the molding room? If it is built at the side, it

and access to a mezzanine floor or gallery over the furnaces to which the weighed mixtures are trucked for feeding to the furnaces through holes in the floor connection to the furnace openings by metal chutes as required.

Charging from an upper floor eliminates a large amount of the untidiness around furnaces, and also conserves time. Material handling is important in the case of electric furnaces, and in one case where this method was installed, the output of the furnaces was increased one-fifth.

It is desirable to keep the vicinity of melting furnaces neat, and nothing

been gouged out to a state of such great uneveness that is dangerous to the workers, and expensive because of the metal loss it promotes. It may be noted that the gratings before the furnaces are of uneven length, which makes it difficult to put a straight back stop behind them to prevent their slipping off the front support. In the foreground a piece of plank is used to bridge a gap at the side of the furnace. The furnaces are the oil-fired, crucible type with an exterior design, somewhat on the order of an oil barrel, and such a shape fails to assist in conforming with the principals of *safety*

first, as no provisions is made for a continuous floor around them. As this installation stands it lacks the neatness of Fig. 2, which is a battery of small furnaces set level with the floor and having square plates at the tops. This leave no spaces around them into which a foot may slip when taking out molten metal.

Avoid Uneven Footing

The manner in which the covers of the furnaces in Fig. 2, are clamped down demands that a portion of the furnace has to be set higher than the level of the foundry floor, and while this of itself is not a bad feature, the protruding handles and lugs around the furnaces are not commendable, as they may catch the clothing of the operators. If these projections were eliminated, or placed at the floor level of the furnaces, provision was made on the outer casing to attach plates of cast iron, two of which would embrace each furnace to make a square extension or top plate such as fitted to the furnaces in Fig. 3, a continuous and secure floor would be made around the furnaces. This would improve the facilities for working them, and lessen the danger of accident.

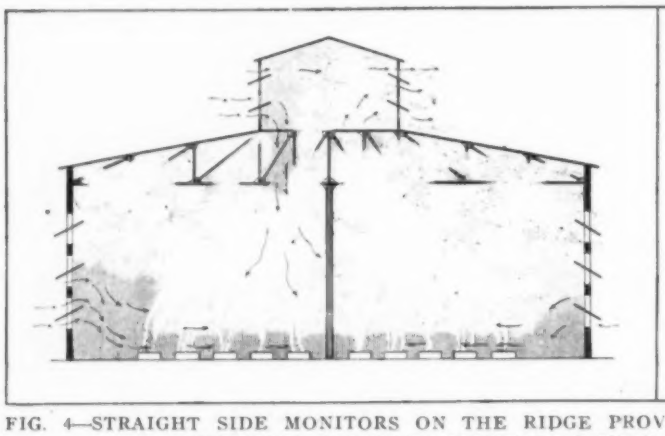
It is more important to have furnaces of the type shown in Fig. 2, set in the manner just outlined, than it is for furnaces of the types shown in Figs. 1 and 3, because the latter are natural draft furnaces and are noiseless in operation. The oil-fired furnace seen in Fig. 2 is noisy, and it is a noise that effectually supresses all other sounds and makes it necessary for the workers to shout at the top of their voices when communicating with each other. The continuous din has such an effect on the workers, that they experience the feeling of being in a trance and while they may perform their work in a satisfactory manner, they are more liable to make missteps. Therefore, all wall gaps around the furnaces should be closed solidly.

Crucible furnaces and small, horizontal barrel-type furnaces melting in bulk, cannot be charged from overhead. The weighed heats must be brought and placed in front of the furnaces, and are then charged by hand labor. The overhead charging arrangement is commended in the case of electric furnaces of the oscillating type, and this method can be used to advantage with any type of furnace that revolves on trunnions and can be turned mouth upwards. Then the chutes may be lowered and the charge shoveled in from above. This method of charging is speedy and saves labor, and is a step in the right direction.

If the furnaces are separated from the molding room, the problem of ventilation for the latter will be greatly simplified, as the fumes and smoke evolved in a brass foundry are much less in volume than those produced in an iron foundry. In the former pouring off proceeds at intervals all day long, while in an iron foundry except in the continuous shops, the pouring is done all at one time at the close of the day, a vast amount of steam and smoke is let loose.

Fig. 4, illustrates a cross section of a foundry which might be either for brass or iron, but the amount of fume evolved from poured molds shows it to be that of an iron foundry, as the molds are larger than those used in a brass foundry, and the volume of metal poured much greater. The illustration shows how this type construction may hold the fumes, due to entering cross winds. Fig. 5, shows a section of another type shop, and illustrates how the fumes arise and pass to the outer air through the openings provided for this purpose. However, it is a mistake even in such a building to locate melting furnaces and molders together, for the reasons stated.

While the designer of a new foundry building has no excuse for subjecting the molders to the discomfort caused by fumes, noise from furnaces and cleaning operations and other discomforts as he can easily make provision for housing these operations separately, with benefit to all concerned, it is not an easy problem to solve in the case of shops already operating under the old conditions. When the furnaces have been placed at one end of the molding room, as is frequently the case, they may be segregated by partitioning them off from the molding room. Sometimes this expedient is not considered with the result it becomes impossible to keep the entire shop free from fumes while the furnaces are running. In such cases, when rapid melting furnaces, not of the natural draft type are used, the situation often will come to such a state, particularly during the cool months of the year, that something has to be done and ventilating engineers have been consulted and have installed fans to throw out the fumes and gases.



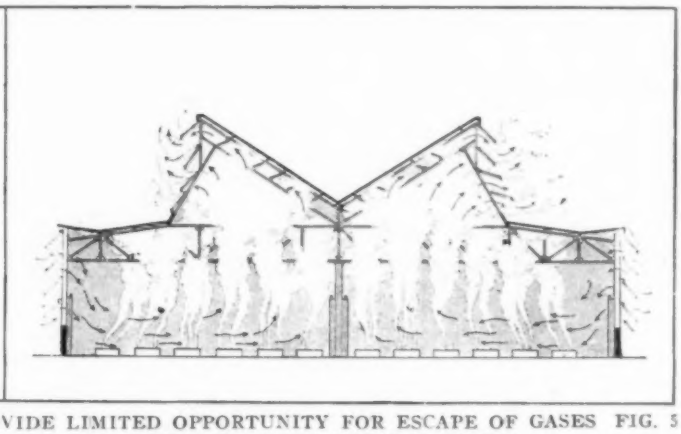


FIG. 4—STRAIGHT SIDE MONITORS ON THE RIDGE PROVIDE LIMITED OPPORTUNITY FOR ESCAPE OF GASES FIG. 5—THE CENTRAL VALLEY SERVES TO DIVIDE THE AIR CURRENTS IN THE MANNER SHOWN

Give Fans a Chance

While these are effective the furnaces produce such an amount of fume that they keep the fans busy. However, if the section of the shop containing the furnaces is walled off and at the apex of the roof above them is placed a monitor with side and possibly end doors which may be opened easily and closed from below, there will be no problem of fumes in the shop, as the doors facing the source of the wind can be closed, and the ones on the opposite side opened. The suction of the passing wind will draw all fumes out of the furnace room. On windless days all the doors may be opened, giving the fumes egress in all directions. As there is always an up-draft from furnaces because of the heated air ascending around them, the fumes will be evacuated satisfactorily in all kinds of weather, and there will be no leakage into the molding room.

The partition separating the furnaces from the molding room some-

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

SPECIFICATIONS FOR GAS WELDING RODS

IRON AND STEEL

General

The following specifications, prefixed by the letter G, are recommended for the purchase of all iron and steel welding rods for use in gas welding. The uses are specified as follows:

Scope

The welding rods herein specified are recommended as covering the usual railroad, shipyard, and industrial requirements as are allowed by authoritative regulating bodies, such as the American Bureau of Shipping, the Interstate Commerce Commission, etc.

Material

Material made by the puddling process is not permitted.

Physical Properties

Welding rods shall be made of annealed commercially straight wire of uniform homogeneous structure, free from irregularities in surface hardness, segregation, oxides, pipes, seams, etc. Diameter shall not vary more than plus or minus 3 per cent from diameter specified.

Nomenclature

The use of the prefix letter G is to indicate that the material is intended for gas welding.

Chemical Composition

The chemical composition of the Welding Rods shall be within the following limits:

G-No. 1A

Carbon	not over 0.06 of one per cent
Manganese	not over 0.15 of one per cent
Phosphorus	not over 0.04 of one per cent
Sulphur	not over 0.04 of one per cent
Silicon	not over 0.08 of one per cent

Standard specifications of the American Welding Society.

(*Continued on Data Sheet No.* 516)

SPECIFICATIONS FOR GAS WELDING RODS

(*Continued from Data Sheet No.* 515)

Recommended Sizes

G. No. 1. A ..... 1/16, 3/32, 1/8, 5/32, 3/16, 1/4, 5/16, 3/8 inch diameters.

Uses

For welding mild steel, structural shapes, plates, bars or low carbon steel forgings and castings.

Surface Finish

The surface shall be smooth and free from scale, rust, oil or grease, and may be plain or copper coated.

Tests

In the hands of an experienced welder, welding rods shall demonstrate good weldability and shall flow smoothly and evenly without any unusual characteristics.

Packing

Welding rods shall be delivered in coils or in straight 36-inch lengths packed and wrapped as follows:

(a) *Bundles* of 50 pounds net weight, securely wired and wrapped in heavy weatherproof paper,

(b) *Bundles* of 50 pounds net weight, securely wrapped in heavy burlap.

(c) *Boxes* or kegs of 100, 200 or 300 pounds net weight, and wrapped as per paragraph (a).

(d) *Boxes* or kegs of 100, 200 or 300 pounds net weight, and wrapped as per paragraph (b).

(e) *Coils* of approximately 50 or 100 pounds net weight and wrapped as per paragraph (a) or (b).

(*Continued on Data Sheet No.* 517)

ESTABLISHED 1859 INCORPORATED 1892

ROOTS

THE P.H. & F.M. ROOTS CO.

ORIGINAL PATENTEES AND MANUFACTURERS OF
ROTARY POSITIVE BLOWERS
GAS PUMPS, WATER PUMPS AND VACUUM PUMPS

HOME OFFICE AND WORKS
CONNERSVILLE, INDIANA

CHICAGO
PEOPLES GAS BUILDING

NEW YORK OFFICE
120 LIBERTY ST.

SEPTEMBER 20, 1923

THE FOUNDRY,
Penton Bldg.,
Cleveland,
Ohio.

ATTENTION OF MR. J. D. PEASE.

Gentlemen:

We notice that you have been featuring letters of your advertisers testifying to the effectiveness of THE FOUNDRY as an advertising medium.

We believe that The P.H. & F.M. Roots Co. have advertised in THE FOUNDRY without a break since the paper was first published. In the early days the Roots colored insert was one of the outstanding features of your paper and was only discontinued during the war times owing to the difficulty in obtaining paper and dyes.

We think that the continuity of Roots advertising is a real endorsement of the value of THE FOUNDRY as an advertising medium. This is particularly true since our advertising in THE FOUNDRY has been relied upon almost exclusively to present our story to foundries, and Roots Foundry Blowers unquestionably predominate in the foundry industry.

Very truly yours,

THE P.H. & F.M. ROOTS CO.

J. B. PATTERSON.

JBP
EML

time is merely a curtain of corrugated iron extending from wall to wall, and fitted closely to the outlines of the roof. Usually this merely divides the upper portion of the shop, as it fails to touch the floor, but is carried on girders to within about 12 feet of the foundry floor. Such an arrangement keeps the fumes out of the molding shop, but not the noise. Therefore, while it is effective as far as fumes are concerned, whether it is entirely satisfactory, or not will depend upon the type of furnaces that are in use. Thus coke-fired tilting furnaces make less noise than oil or gas-fired ovens and electric furnaces make little noise, so such a partition or curtain is satisfactory with these furnaces, but it is not as good in the case of oil-fired, noncrucible furnaces that are noisy, because while a curtain wall is being built it might just as well be brought down to the floor level, and one or more openings or archways made for the passage of the metal into the molding room. If these openings are fitted with steel roller doors, the furnace room may be isolated completely when desirable.

A furnace room separated by a curtain wall, not touching the floor, will not required air ducts at the floor level, because air will flow from the molding room into the furnace room and upwards with the fumes. Incidentally, this will carry away the heat from the molding room, so it will cost more for coal in winter. The completely isolated furnace room will need ventilators at the ground level. In fact ample provision should be made for openings in the furnace room, and if the sides can be so arranged that they may be rolled up, or removed in summer, so much the better.

In making alterations to free molding shops of furnace fumes, it is important to know that the only effective way is to have generous roof openings. In one case, a curtain wall was dropped down to a reasonable height from the floor, and completely divided the upper part of the shop, but instead of cutting away the roof and fitting it with a raised portion with side doors, the old sheet iron stacks formerly carrying the useless ventilator hoods were left in place, but the hoods were taken away. The result was disappointing, for while the circular stacks were probably 24 inches in diameter, the fume passed through them languidly, and much of it filtered back into the shop. Fans then were placed within the stacks and some measure of relief obtained. The whole scheme was more costly, and inferior to the method of ventilating by elevated roof openings.

The casting cleaning machinery is less frequently incorporated as a part of the molding room, than are the furnaces, but it is not a novelty to see saws, sprue cutters, grinding wheels and chipping hammers busily engaged in finishing castings within the sacred confines of the producers room. They have no business there. Flying chips are no respectors of persons, or of molds, either. This work should be housed separately and it can be completely cut off from the foundry. In new buildings this generally is done, as the cleaning inspection and the shipping room form a department by themselves. They should be as near together as possible.

About the location of the core room, little need he said. It usually is housed separately from the molding room, or foundry, and subdivided into coremaking and core baking rooms. These may be adjacent to a core-sand room fitted with the machines required for such work.

Progress in the direction of a betterment of the conditions now obtaining in brass foundries will be made when it becomes the exception and not the rule to find furnaces melting metal and molders pounding up molds and pouring them off, all under the same roof in one large room.

In addition to dividing the foundry into departments, it will be a great improvement if the shops are kept clean. All brass foundries should be paved with brick, woodblock, or concrete floors. A concrete floor with brick laid on top is satisfactory. Such a floor will not burn, and spilled metal will not explode and fly about dangerously. Such a floor can be kept swept and tidy and it pays to have someone detailed to do such work, gathering the spilled brass from floor and molds, putting flasks handy for the molders, sweeping the spilled molding sand and piling weights and flasks tidily.

Progress towards more comfortable surroundings in brass foundries will bring its own reward in a lessened labor turnover. Further, it will be accompanied by progress toward better, or more perfect castings, which can be translated as meaning a greatly curtailed production loss.

How and Why in Brass Founding

By Charles Vickers

Mixing Bronze Scrap

We would appreciate greatly information as to whether manganese bronze and phosphorus bronze can be mixed successfully in making a clean casting, which will be machined all over. This metal is scrap.

Mixing two dissimilar alloys such as manganese bronze and phosphor bronze would result in castings only fit to adorn the scrap pile. If it were possible for a brassfounder to remove the aluminum from the manganese bronze, the admixture of such dealuminized alloy with phosphor bronze would result in adding zinc to the latter alloy. Castings can be made of such an admixture and good results obtained. Therefore, if the aluminum can be removed from the manganese bronze, the alloy with tin and phosphorus and zinc and copper can be used to advantage for bearings, as every old-time foundryman knows. However, manganese bronze with its content of aluminum cannot be used, as it would be impossible to get clean castings from such an admixture. Whether or not this admixture of scrap metals can be used hinges on the aluminum present. If the process for removing the aluminm is known, everything will be fine but watch the pouring temperature of the phosphorize zinc alloy. Let the metal cool until it adheres slightly to the iron stirrer. At this point take the temperature for future reference, but be quick about it, as the alloy solidifies with remarkable rapidity.

Aluminum Patterns

We are called upon to make patterns of aluminum and we use a mixture of 75 per cent pure aluminum and 25 per cent zinc. We find this gives a lot of shrinkage and leaves hollow parts on the castings. Can you suggest a better mixture? Also should there be hollow spots how can we weld them up?

A better casting mixture would be aluminum, 92 per cent; copper, 8 per cent. This may be made by adding 16 per cent of a hardener composed of half copper and half aluminum to 84 per cent pure aluminum. Melt both the hardener and aluminum together. There should be no hollow spots, but where there is a tendency for them to form this

can be corrected by ramming up chills in the mold at these points.

A massive section anywhere that cannot be fed by a riser or that cannot easily be reached by molding in a chill, can be chilled by first casting a ball of aluminum on the end of a nail, then pinning this in the mold centrally in the heavy section. In pouring, of course this internal chill must not be colder than the sand of the mold, otherwise moisture will condense thereon and it will blow. In that case use a long nail or a piece of long wire, and allow it to protrude outside the mold several inches, then just previous to pouring heat this end that sticks out with a torch and the heat will run along the stem and warm the chill and thus evaporate moisture and there will be no blowing.

Rolling Mill Bronzes

We are sending two samples of bronze for rolling mill bearings. The analysis of sample No. 1 follows; copper, 71.30 per cent; tin, 5.50 per cent; lead, 22.65 per cent. Sample No. 2 was made of copper, 72 per cent; tin, 6 per cent, and lead, 22 per cent. Sample No. 1 was cast by another foundry and the users claimed they got twice as long service from this bearing as they got from one of No. 2 formula. The makers of No. 1 claim they cast their bearing in a vacuum, which makes a thoroughly homogeneous mass and there is absolutely no segregation shown by the lead. This, they claim is the reason No. 1 sample lasted longer than No. 2. Could you give us any reason why No. 2 failed to last as long as No. 1, or explain how we can duplicate No. 1? Both bearings were used without having the surfaces machined. Would a difference in the hardness of the metal affect the length of wear?

It is not possible to discover wherein the two alloys differ except by means of a scientific investigation which would include several chemical analysis and a number of micrographs. The story of casting No. 1 alloy in a vacuum is neither possible nor necessary, as such an alloy is not so active chemically, that it would be improved either by casting in a *vacuum* or in a neutral atmosphere. Furthermore, the molds were made of sand and the alloy runs perfectly fluid and needs neither pressure, or reduction of pressure. However, the lead is held in admixture better than in the case of No. 2 alloy, which suggests that a flux was used when melting the alloy. A suitable flux is plaster of Paris mixed with 10 per cent of soda ash. This is added to an equal amount of fine charcoal. Use 1 or 2 per cent. The alloy would be improved by the addition of 1 per cent nickel, added as an alloy of half copper, half nickel. As the bearings are not machined, a thin veneer of lead on the bearing is an asset. Therefore, the slight segregation of lead on the bearing of No. 2, will work no harm. We are inclined to think the report of No. 1 bearing having lasted twice as long as No. 2 bearing is not an impartial one, and that the vacuum existed in the mind of the one responsible for such a report.

Casting Aterite Alloy

We desire to learn what kind of an alloy is Aterite. What is it composed of; what is it good for; and whether it is an acid-resisting metal.

Aterite is a name given to a series of alloys. The composition of these alloys varies but the best of the group is what is known as No. 9 Aterite, the composition of which follows:

No. 9 Aterite

	Per Cent
Copper	55
Nickel	30
Iron	6
Zinc	9

Since this alloy is patented, it would be well to go carefully in making and selling the same. It is not an acid resisting alloy in the sense of resisting all acids. It may resist some dilutions fairly well, but dilute hydrochloric acid is not one of them. If cast soundly it will withstand sulphuric acid solutions better than copper-tin alloys but if not, it will be inferior to a copper 90 per cent; tin 10 per cent alloy absolutely free of oxides. To obtain the latter extremely desirable condition, it is necessary to first deoxidize, then remove the products of the deoxidization and the remaining deoxidizer.

Outside of its acid-resisting qualities, Aterite has one valuable property, namely that it withstands superheated steam in a gratifying manner. For this reason it is used extensively for such equipment. It is not the easiest alloy to make and there are founders who have worked with it and lost considerable money in the endeavor to make sound castings. It is not as difficult as steel to cast, therefore, it can be mastered by the use of common sense and a knowledge of the sand casting business.

Preventing Segregation

We would like to learn how sulphur is used to prevent the segregation of lead in the case of an alloy of copper 60 per cent, lead 40 per cent. In just what form is it added?

Sulphur is added to highly leaded alloys in the form of roll sulphur, and when combined with other elements in the form of sulphates and sulphides.

When sulphur is used, it frequently is tossed onto the surface of the molten copper before the lead addition is made, while sometimes it is added after the lead. There is no uniformity about the method of adding sulphur, and no uniformity about the results obtained. The sulphide most used is lead sulphide which is added in the form of the most common ore of lead namely galena. The sulphate most commonly used is plaster of Paris or calcium sulphate. The powder is added, half with the cold metal and half to the molten admixture of lead and copper. Any other sulphate that suggests itself also can be used.

Not all methods are uniformily successful in retaining the lead. Some workers use one method and fail with another, and vice versa. Therefore, if failure attends one method, try another.

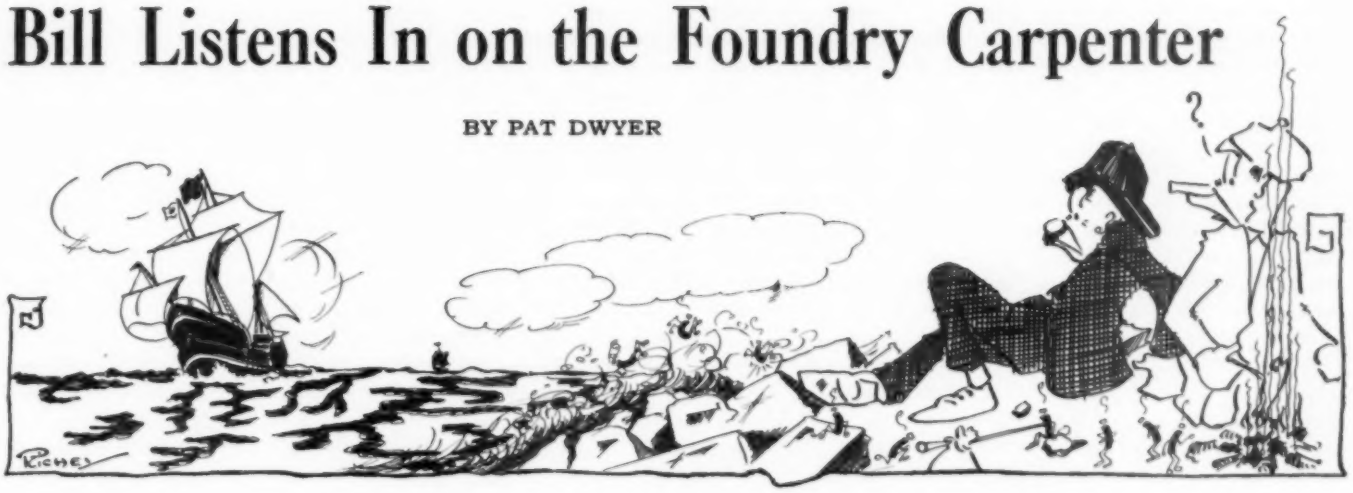
Scrap Manganese Bronze

We have on hand a quantity of scrap manganese bronze and desire to learn if it could be put in shape for small castings by adding copper. We want to turn it into material for all round brass purposes. Also, we have noted that some of the castings made from scrap are cracked. The molder claims this is caused by manganese being present. Do you think this is so? If so, then the addition of from 25 to 50 pounds of copper to each hundred pounds of manganese bronze would not make a good mixture. We would also add the proper amounts of tin and lead.

The difficulty encountered in using scrap manganese bronze does not come from the manganese, as this content is extremely low generally, but from the aluminum it contains. Because of the presence of this element the scrap cannot be converted into red brass as outlined in the query. The best way to use this scrap is as an aluminized yellow brass, the latter alloy being suitable for a cheap line of castings which do not need to be made of red brass of good color. The scrap can be converted into an aluminized yellow brass by weighing out 50 pounds for each heat of one hundred pounds. Melt this 50 pounds of manganese bronze with 30 pounds of copper, and when the heat is molten add 20 pounds of zinc. If the castings must be machined, approximately 2 pounds of lead also can be added, deducting two pounds of the scrap manganese bronze. Such an alloy has many uses. The manganese does not cause any cracks in brass castings, but rather it strengthens the alloys and prevents cracks. It is used as a deoxidizer in copper-tin alloys right along. The cracks may be caused by the aluminum, but no opinion could be given in regard to their origin without inspection of the castings.

Bill Listens In on the Foundry Carpenter

BY PAT DWYER

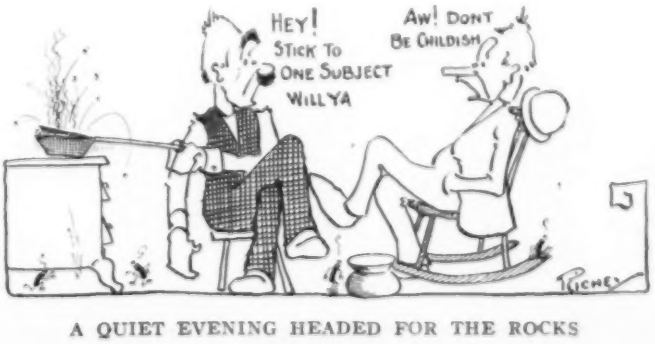


RECENTLY in a maritime paper I read a series of articles dealing in a breezy and highly interesting manner with the era of the famous old clipper ships, with the men who designed and built them and with the ramping, stamping, daredevil skippers who drove them under clouds of billowing white canvas to the world's end and back. These men long since have been gathered to their fathers and now sleep calmly in the haven under the hill. Their names, together with the names of the beautiful ships they commanded with such skill and daring, are only a memory that in a few more years probably will have been forgotten entirely. Superb seamanship backed by iron nerves and indomitable will were required to bring the FLYING CLOUD, RED JACKET and other China tea clippers down the inside passage of the China sea, past the pirate infested waters that flow by Java Head, across the Indian ocean and around the stormy cape of Good Hope. Here they were caught up by the whistling trades where day and night the long sea miles rolled swiftly astern. Eventually they swung into the roaring forties and came storming into their home port, Boston, New York or Baltimore only 80 odd days out of Hongkong, Kowloon or Shanghai on the far away, oriental and spicy side of the world.

In the golden days when freights were high and carriers few it was not uncommon for a new vessel to clear her entire first cost in a single voyage. To a great extent this explains the mania for speed and for the fact that these deep-sea flyers accepted charters that at times carried them around the circumnavigable globe. In the days of '49 when the gold rush to California was at its height, penguins drawn up in martial array on the desolate rocks of Terra del Fuego became accustomed to the sight of a shining hull and reeling masts flying eastward before a driving gale on the crests of the long Cape Horn rollers. Almost before they were aware of her passage the ship was gone. They caught a flash of white sails, heard a faint echo of a roaring, deep-sea chantey as the yards were braced and the racing clipper swung her head to the north toward the equatorial waters of the Caribbean sea.

On other occasions the same penguins saw a sorely buffeted vessel headed west for weeks on end bucking head winds, mountain waves that broke in cascades over the bows and rolled aft in swirling floods of green water, sleet, rain, and snow that crusted the standing rigging and converted the sails into sheets as hard and stiff as so many pieces of boiler plate.

Backing and filling, at times blown out of her course to the verge of the great Antartic ice pack, dogged determination and iron physique and a spirit that never recognized either defeat or surrender, invariably won through. Eventually in the calmer waters of the Pacific the hairy sea dogs comprising the crew and the hardy adventurers who made up the passenger list were given opportunity to recuperate while the ice melted from the sides and the vessel slid north past the west coast of the long, weary South American Continent.



A QUIET EVENING HEADED FOR THE ROCKS

The LIGHTNING, the GLORY OF THE SEAS, the CYPRUS and the MARCO POLO all were commanded by men to whom the word fear was unknown, whose religion was speed, who knew to an ounce the pressure each individual sail was capable of withstanding short of being blown out of the bolt ropes, and what pressure the combined suit of sails would resist before they would cause the vessel to turn turtle or before they would whip the sticks out of her. On one memorable passage across the western ocean in the late fall of the year it is recorded that the crew of the CYPRUS never saw their own lee rail from the time the Lizard was dropped astern until they picked up Fire Island light 9 days later and backed the clipper's straining yards while they snapped up a pilot.

Bully Forbes on one of his many round trips brought the MARCO POLO from Sydney, Australia to Liverpool in 67 days and thereby established a record that never has been equaled by any vessel propelled by sail. He cleared Sydney on the same day as the regular steam packet and beat her home by the comfortable margin of 10 days.

Steamboats then were not as fast as they are now, but it is worthy of note that the MARCO POLO equaled the speed of many a modern liner. For days at a time she consistently logged over 430 miles or at the rate of 18 miles per hour. She met her first head winds in the English channel and although in sight of land, lost two days before finally dropping her Australian mud stained hook in the Mersey. After a long and eventful career she finally passed under the registry of a foreign flag and her dynamic captain retired to a quiet country life. The man who had carried his life in his hand for years, who had braved storm and tempest and all the perils of

those who go down to the sea in ships and adventure on the great waters, died peacefully in bed and was buried in a sheltered English churchyard not far from the siren call of the sea that had lured him in the days of his youth and that had held his allegiance for so many years. A modest white slab marks his resting place and in addition to his name and the date of his birth and death, bears a single line: Master of the MARCO POLO.

Knowing Bill's interest in nautical affairs, an interest probably inherited from wild, sea roving ancestors, an interest also to some extent due to the fact that he was brought up in an ocean port where he had cherished dreams of a life on the ocean wave and all that jolly old kind of rot. I loaned him the papers and later asked him how he was impressed by their perusal. "Well," said Bill, "I'll tell you. My only regret is that I was not born 70 or 80 years ago. There were no foundries down our way at that time and every brave young lad went to sea. Of course they did not all become masters of racing clippers. Many became owners or part owners of small vessels, mostly schooners, that traded up and down the Atlantic coast. Usually the limit of their run was the West Indies with perhaps an occasional trip to the Labrador on the north or to far off southern Buenos Aires on the River Plate. The majority of the skippers knew enough navigation to find their way around, but there were not wanting men who did not even know the rudiments of the science and yet who were eminently successful in their chosen calling. A typical exploit in the career of one of these lads was related to me one time by the old foundry carpenter.

"The old man was quite a character in a way. In his young days he had helped to build and sail ships and although at least 65 at the time I knew him he could handle the tools of his trade and fit up a flask to the queen's taste. You probably have noticed the difference in foundry carpenters in this respect. I have seen men who could give many a molder lessons on the subject, while others—"

"For the love of Ananias," I said, "stick to one subject. You start in to tell a story about one of these barking dog sailors who hug the shore and at night verify their position by listening to the hounds yelping at the various farms. Instead of continuing, you calmly switch to a discussion of the proper method of barring a wooden flask. Certain people might be able to follow you, but I can't. Finish the story about the sailor first."

THE RHYME OF THE ANCIENT MARINER

"Don't be so impatient," said Bill. "It shows a childish disposition, the peculiar state of mind that prompts a child to suggest that you skip all the details and come immediately to the big scene in the story of Little Red Riding Hood where the wicked wolf 'Grabs her and eats her in a bite.' I'll come to the sailor in a minute, but since the story is not mine it is only fair that I should say a word about the author. Without a knowledge of his sterling integrity you might be tempted to doubt his story of how Hector McFarlane, better known as Big Hector, drove the MARY OF ARGYLE through a dense fog from Boston to Port Morien on the eastern tip of Cape Breton island.

"Whatever weakness the old carpenter may have had in his youth he was a model of propriety at the time I had the pleasure of toiling in his company. True he was an inveterate chewer and smoker and indulged in a snifter or two of red rum every payday, but then rum was rum in those days and only served as a slight talking stimulant. I shudder to think of the fearfull and wonderful narrative he probably would have spun under the influence of the liquid lightning dispensed today.

"It was on one of those occasions while the gang sat around the salamander at noon that he related the history of Hector's famous voyage. He carefully explained that he was not a member of the crew but he knew them all intimately and had seen the schooner the day after she arrived. Was not that evidence sufficient to satisfy any reasonable man? Big Hector neither could read or write and looked upon a compass as a totally unnecessary piece of ship's furniture. In his queerly constituted mind he had a perfect map of the Atlantic coast from Labrador to Gloucester and experienced no trouble in taking his schooner any place he wished to go. He passed Boston light outward bound on an ebb tide at 4 bells on a Wednesday afternoon and before 8 bells midnight was enveloped in one of the impenetrable fogs that roll in periodically from the Georges. The mate wanted to strip her and lay to until the fog lifted but the captain announced that he intended to drive her home in spite of all the fog in the North Atlantic. The narrator described the course in great detail with special reference to the fact that down to this day no one knows how in the name of God the schooner escaped the treacherous sand banks of Sable island.

"Finally after three days sailing, the mate and the remaining members of the crew threatened to mutiny if the skipper did not lay to. They pointed out that in treir opinion the schooner either was somewhere on the Grand Banks and, therefore, directly in the track of the transatlantic liners, or she was too close to the shore for safety. The skipper laughed and told them that he expected to hear the bell buoy off St. Paul's island in less than an hour. In 55 minutes by the galley clock they all heard the bell and the schooner was swung on the port tack and headed due west

THE GUEST PROBABLY WOULD FEEL MORE AT HOME IN RESPONDING TO THE WELL KNOWN "HERE'S HOW!"

until through the rolling clouds of fog they heard the boom of the fog horn on Scatterie. It was now pitch dark night in addition to the fog. They were approaching their destination and any person except a hare brained fool would hesitate to venture in search of the harbor entrance. The crew stood by shivering, waiting every moment to find themselves piled up on the rocks. When after a seeming eternity, Hector passed the word, you can bet your bottom dollar the sails were dropped and the anchor chain let go in a manner that would have reflected credit on the smartest man'o'war's crew that ever stepped. 'You can believe it or not,' said the old man as he stuck a soldier in the fire to relight his pipe, 'but when the crew tumbled up on deck the following morning, the sky was clear, the sun was shining and the bowsprit of the MARY OF ARGYLE was within a fathom or maybe a fathom and a half of her owner's wharf!'

Inside Stuff

"Now, there y'are," said Bill. "Every one to his own business. I don't know much about sailing a ship, but I know something about barring a flask and I often admired the skill displayed by the old carpenter. To an amateur or a casual visitor in a foundry, the manner in which bars are placed in a flask might appear to be a matter of little moment, but I had been brought up in an old fashioned foundry and, therefore, could appreciate the fine points involved.

"We had a foundry carpenter who cut our lumber, built new flasks occasionally and made himself generally useful around other shops in the plant besides the foundry and pattern shop. We had a bench axe and a hand saw with which each man did his own repairing. I thing we were just as proud of our ability to bar a flask properly as we were of our skill in making the mold. The firm handled a general line of jobbing castings including mining, marine, lumber, paper mill and steel works machinery in which many of the flasks, particularly those on the heavy floors had to be constantly changed to accommodate various patterns.

"Bars are placed in a flask for the purpose of supporting the sand. They prevent the sand from falling out when the cope is removed from the drag and later while it is suspended over the empty mold. Also they prevent the sand from being forced upward owing to the pressure of the molten iron when the mold is filled.

"It was a positive treat to see the old lad strip a cope and rebar it. He knocked the old bars out with a light sledge hammer and left them in a pile for the cupola men. Then with the assistance of several helpers he lifted the frame upon a large bottom board if one was available. Otherwise he placed the frame on two long planks supported on suitable horses. He plucked out the nails remaining in the sides with a steel bar bent into a half circle at one end and split like a clawhammer. The construction of the bar enabled him to exert a leverage that would pull any size nail up to and including a 6-inch spike.

"The cope pattern was placed on the planks and adjusted to the best advantage approximately in the center of the flask. He chalk marked the top of the sides into the required number of equal spaces for the bars and then with his square, projected the lines down to the bottom of each side. A piece of wood, 1 x 1 inch, and the full depth of the flask was nailed securely and vertically at each mark and then he proceeded to fit the bars. Wide boards extending from side to side and with a gap conforming to the contour of the pattern cut in the center, were nailed through the ends to the sides of the flask. The long strips served as a guide and a brace.

"Assuming that the pattern was for a pipe casting he next proceeded to extend the bars down to the sand joint. Pieces of board corresponding to the depth of the cope were cut and then nailed by the upper end to the long main bars. Where the casting was to be poured in green sand the ends of the upright pieces were allowed to touch the joint at all points except in the immediate vicinity of the gates. Pipe castings sometimes are poured through pop gates located on the flange or the body and in those instances all the up-and-down pieces of boards are allowed to touch the sand joint.

He Said Grace

"This is only common sense and yet it is surprising to find how many molders insists on keeping the edges of all bars at least ½ inch from the face. Clearance is necessary over a pattern, but it stands to reason that a bar touching the joint will support the sand better than where it is kept back ½ inch or more. This feature long has been recognized by makers of flasks to be used with molding machines. Machines are designed to facilitate production and where the bars are allowed to touch the joint, gaggers may be omitted. Every gagger dispensed with means a gain of a few seconds in time.

"However," said Bill, "I have no intention just now of entering into a complete description of how a flask should be barred. Local conditions to a great extent determine the best method to adopt. What I started to talk about is that I like to see a man stick to his own business. When he ventures outside he stands in imminent danger of what the vulgar call putting his foot in it. Sometimes he tangles both feet.

"Consider the case of the correspondent of the large firm who was invited to dinner at a friend's house. At table he was requested by the friend to say grace. This was something altogether outside his regular experience but he never batted an eye. He rose gallantly to the occasion.

" 'Dear Lord,' he began, 'we thank Thee for all Thy favors of recent date. Permit us to offer our heartfelt gratitude and appreciation of Your valued consideration. We sincerely trust that we may continue to merit Your distinguished confidence and that we shall receive many more blessings from You in the future. We beg to remain your's —er—Amen!' "

To Call Conference on Cast Iron Pipe

A special committee of the American Engineering Standards committee, at a recent meeting, voted that this committee should recommend "that the American Engineering Standards committee call a representative conference on bell and spigot and flanged cast iron pipe fittings, to consider the development of specifications covering dimensions and materials." This action resulted from a review of two sets of specifications for cast iron pipe submitted by the American Gas association and the American Society for Testing Materials.

The American Gas association submitted three specifications covering cast iron pipe and special castings, bell and spigot pipe and special castings and flanged pipe and special castings. The American Society for Testing Materials also submitted for approval specifications for cast iron pipe and special castings, suggesting at the same time that the whole question of specifications for cast iron pipe covering all of its uses, should be considered.

As a result of the committee's recommendation, the chairman of the American Engineering Standards committee was authorized to call the conference as outlined. It was understood that the conference would consider soil pipe and other light types of cast iron pipe, with respect to possible standardization.

The Buckwalter Stove Co., Royersford, Pa., has awarded a contract for the erection of a new enameling plant, 100 x 300 feet, to the Beling-Bush Co., Inc., Drexel Bldg., Philadelphia.

States Carbon Control Theory

Sulphur to Manganese Ratio Said to Exert a Regulating Influence on the Amount of Carbon in Gray Cast Iron and on the Ratio of Combined to Graphitic Carbon

BY A. C. PORTER

THE knowledge of carbon, its effect and control, that the foundryman melting with the cupola has access to is meagre. It could be covered by the three following statements: Carbon is absorbed in passing through the cupola, the amount varying with conditions; the amount of carbon precipitated from the combined to the graphitic state is controlled by the silicon content and rate of cooling; the use of scrap iron in the mixture is to dilute the total carbon in the casting. All of these statements are generalities and are of no practical value to the progressive foundryman who desires to have a close control of the carbon mixture and is not content to work in a hit or miss way with this element.

By comparing the cupola and the blast furnace it seems apparent that from the bosh down, the reactions which take place in the blast furnace are practically identical with those which take place in the melting zone of the cupola. The reduction from the iron oxide of the ore to pure iron occurs in the upper regions of the blast furnace, known as the throat and shaft. The sequence of reactions is as follows: Oxygen entering through the tuyeres immediately comes in contact with incandescent carbon and forms CO gas. This gas comes in contact with an excess of unburned carbon and the unbalanced compound CO is formed. Because CO is an unsaturated compound there is a strong tendency to take up another atom of O, and this action is powerful enough to attract the required oxygen from combination with iron. The reduced iron arrives at the bosh of the blast furnace in the form of an iron sponge, the excess of heat caused by complete combustion of carbon and oxygen melts and superheats this sponge, causing it to trickle down through the incandescent coke, and during this passage it absorbs carbon.

Pure iron has the power to absorb about 4.60 per cent of its weight of carbon at this high temperature. The amount taken up depends upon high hearth temperature tending to high absorption of carbon, and a small slag volume causing an excess of hearth heat, consequently allowing more heat available for the metal which tends to high total carbon. The reverse of these conditions tends to lower total carbon. Silicon also has a tendency to lower the amount of total carbon in cast iron, as indicated by the following table.

Silicon Per cent	Total carbon Per cent
4.00	3.20 to 3.25
2.00	3.70 to 3.75
0.50	4.50 to 4.60

Manganese has the power to counteract the effect of silicon, and iron high in manganese tends to higher total carbon. The furnace operator can control the silicon, manganese and sulphur contents to close limits, and the total carbon can be controlled by these elements. Therefore, it is apparent that in blast furnace practice a close control of the constituents of cast iron is possible. Owing to the similarity of the melting conditions in the cupola and blast furnace, the author believes that by a close study of the methods used by the blast furnace manager to control the carbon by hearth temperature, silicon content, and the manganese-sulphur ratio, a factor or ratio can be devised that will give results which can be of practical use in controlling the carbons of iron melted in the cupola.

Cupola Is Efficient

The efficiency of the cupola as a metling medium is higher than that of any other type of furnace, consequently it would be well to give considerable study and observation toward the end of improving our knowledge of its operation rather than to seek some other melting unit. It is possible with an understanding and application of the chemical reactions which take place, to operate the cupola with clock-like precision. It is also possible to vary the heat conditions in a manner similar to blast furnace practice. This would have a tendency to vary the carbon content of the metal. The heat of combustion in the cupola is obtained by burning incandescent carbon with the oxygen supplied by the blast. The amount of heat available to melt and superheat the charge can be varied by changing the weight of the charge of metal. It is not good practice to disturb the amount of blast or coke. They should be kept constant and the weight of the metal charge decreased or increased, similarly to the method used in blast furnace practice. If the blast furnace operator finds the hearth temperature is high, which will produce an iron of undesirable quality, the burden is increased; that is, more ore and limestone are added per charge of coke, causing a lower hearth temperature. In the cupola this can be accomplished by increasing the melting ratio. It has been observed that with a melting ratio of 8 to 1 between charges, more carbon is absorbed than in a 10 to 1 ratio.

The matrix of a soft gray cast iron, by which is meant an iron easy to machine at surface speed of 45 to 50 feet per minute would consist of pearlite, graphite and free or excess ferrite. The matrix of a strong hard cast iron would consist of pearlite, graphite and free or excess cementite, i e., combined carbon.

It has always been conceded that the silicon content has an influence on the relative proportion of combined to graphitic carbon in the iron. However, to the writer's knowledge the reason for this has never been satisfactorily explained. It is his thought that the silicon is in combination with the ferrite, when considered on the basis of proximate analysis of the matrix. If this is correct, then may it not be assumed that the heat generated by the formation of iron silicide, FeSi, is responsible for the first expansion of the gray iron cooling curve, which is caused by the precipitation of the graphite. Then the higher the silicon content the greater will be the amount of heat generated, hence the more time given for the casting to cool through the graphitization period of temperature. Silicon combining with oxygen or iron generates considerable latent heat of formation. It is acknowledged that the slower the casting cools, the greater will be the amount of graphite, then it seems logical that it is this latent heat of formation caused by FeSi that allows the casting more time to cool through this critical range.

The most active elements in counteracting the effect of silicon, are manganese and sulphur. Manganese has a greater attraction for sulphur than iron, so that given sufficient manganese practically all of the sulphur will enter into combination as manganese sulphide, in

the ratio 1.7 manganese to 1 sulphur; thus 0.07 per cent sulphur will form 0.07 X 1.7 or 0.119 manganese sulphide.

The author's observations have seemed to show that there is a definite ratio or or factor applicable to the calculation of the graphitic and combined carbon content of a given cross section of metal, when different mixtures are cast in this given cross section. It is not the writer's intention to claim that the combined carbon in any casting can be calculated, but there is a practical starting point from which a foundryman can, if operating the cupola, by scientific control, calculate the total carbon and the condition of the carbons in one standard cross section of metal, using this standard as a guide from which to judge the condition of the carbons in the castings of different cross sections. For instance, if the test bar shows 0.48 per cent combined carbon and 3.00 per cent graphic carbon, the castings of lesser cross section would have more combined and less graphitic; and vice versa for castings of greater cross section than the test bar. It should be preceived readily that a foundryman making tests every heat would in less than one month have data available that would show a definite relation between the silicon to manganese ratio, and the amount of total carbon absorbed by the metal in passing through the cupola, and also of the condition of the carbons in the test bar. It is conceded that different foundries have different conditions, which effect these constituents so that it would be unpractical to give calculations which apply in one foundry and expect that the same factor or ratio could be applied to any other foundry. However, if care is taken in molding and pouring the test bars under as near the same conditions on each test; that is, making the mold on a machine, using sand of the same consistency, and pouring the metal at approximately the same temperature, the similiarity in results obtained will soon convince the most skeptical one that there is a definite ratio between these elements.

The method used for collecting and tabulating data is as follows:

Find the ratio of silicon to manganese after deducting the approximate amount of manganese for manganese sulphide.

Find the amount of carbon absorbed or lost by the mixture in passing through the cupola, by comparing the estimated analyses with the actual analyses.

Tabulate the percentage of graphitic carbon and combined carbon, and compare the three items with each different grade or analysis of metal. It will soon be evident that a factor exists, possibly different in each particular foundry, but of vital importance to each foundryman as it relates to his plant.

The writer has been making experiments and tabulating data in regard to this method for some time, owing to the necessity of finding a starting point in controlling the carbon in cast iron. Is it not time that some concentrated effort be made to enable foundrymen, using modern methods, to cease working in the dark on the control of carbon? It is felt that it would be a benefit to the foundry casting industry if it were possible to assemble data from a number of foundries, thus enabling someone to find a practical solution for this problem.

Safeguarding Oxyacetylene Welding

BY H. S. SMITH

THE record of the oxyacetylene industry is wonderful and the number of accidents is infinitesimal under the rapid growth of the process and its wide use. I think it is not possible to cite an industry in which oxyacetylene welding is not employed.

Before you can use oxyacetylene welding you have to purchase equipment and in order to safeguard yourself your purchasing agent should specify acetylene generators, blow pipes, regulators and other apparatus in strict conformance with such types as are officially recognized and approved by the Underwriters Laboratories in Chicago. Likewise he should call for the gases in cylinders manufactured according to specifications of the interstate commerce commission and marked as signifying that they so comply. Instructions supplied by manufacturers of acetylene generators and other equipment should be followed closely.

Calcium carbide does not constitute a fire hazard, but when it is brought in contact with water acetylene is generated and acetylene is an inflammable gas. Therefore, calcium carbide should be stored only in dry and well ventilated places. It should be appreciated that whether calcium carbide is stored in a separate building or in an acetylene generator house, the location should be illuminated only with incandescent electric lights guarded to prevent the globes from being broken; all switches should be outside the building as should other spark-emitting devices, including the telephone. Where calcium carbide is stored in large quantities in a separate building or compartment, it is desirable, where feasible, to have the floor of the building level with the floors of the railway cars and trucks.

It is bad practice to have cylinders of compressed oxygen and acetylene stored indiscriminately around the premises. Where compressed gases are used you will naturally have to have a cylinder of oxygen and a cylinder of acetylene at each point where the welding work is being carried on but cylinders not in actual use should be properly and methodically stored. Acetylene cylinders should be handled carefully. In the case of carbide, it is desirable, where possible, that the warehouse have the floor level with the car and truck floors, but naturally this is possible only in establishments having their own car siding.

The acetylene generator can be housed in an isolated building; it can be housed in a lean-to adjoining the plant; or it can be installed inside one of your plant buildings. A separate, isolated gas house is ideal, especially so if you have a substantial structure with floors at truck floor level and divide the building into three or four compartments, using one section for acetylene generators, one or two sections for calcium carbide and acetylene cylinders, and another for storage of oxygen cylinders.

The isolated generator, carbide and gas storage warehouse need not necessarily be of fireproof construction, although such is preferable.

Be sure to see that the generator stands on a substantial and firm foundation. I have known of cases where generators were put up on a flimsy foundation, which was later undermined by the water discharged from the generator and, as a result, the generaters canted over and broke off certain piping connections, causing serious trouble.

A generator room must be protected from freezing. This is most important. Freezing of acetylene generators is the cause of 50 per cent of the accidents that have happened with them. Generator houses should be provided with plenty of daylight and plenty of head room. It must neces-

Abstracted from a paper presented at a joint session of the National Safety council and the National Society of Safety Engineers, New York, Jan. 22, by H. S. Smith, Union Carbide & Carbon Co., New York City.

sarily be well ventilated and also be provided with sufficient artificial illumination. This must necessarily be incandescent electric, with globes protected and with switches outside the building.

In the majority of cases oxygen is used direct from a standard oxygen cylinder, a separate cylinder being used for each welding station or blowpipe. In some instances, however, a number of oxygen cylinders are manifolded, the gas being supplied to the shop through a system of piping. In rare cases oxygen is manufactured on the premises, the gas being first collected in a gas holder and then compressed in the receivers to a pressure of a few hundred pounds, passed through a regulator and supplied to the welding station through a system of shop piping. When assembling the manifolds in the piping system, great care must be taken to see that fittings are handled with clean hands. Grease on a joint or on the interior of the piping might cause severe trouble. The interior of the piping must be clear of all scale and rust, and should be thoroughly washed with caustic soda before being put in service. When starting an acetylene generator the first time, instructions of the manufacturer must be followed in detail. Under normal working conditions the pressure of the acetylene pipe line generator will never exceed 15 pounds per square inch. Pure acetylene gas without any air mixture, at any pressure below 15 pounds per square inch is nonexplosive. If the same cylinder were filled with acetylene at 30 pounds pressure and no air present and the spark plug was sparked there would be a violent explosion. The action of acetylene under pressure between 15 and 30 pounds per square inch is somewhat uncertain but authorities have definitely decided that acetylene should never be used in the free state in excess of 15 pounds per square inch.

It is also desirable to have two workmen trained properly to operate the acetylene generator. In the recharging of acetylene generators it is most important to follow the orders and instructions for consecutive operations as laid down by the manufacturer. Special attention should always be given to make sure that the hydraulic seals and backflash devices at the discharge of the generator are properly filled with water and in proper working order.

If repairs have to be made to an acetylene generator, the whole machine should be thoroughly flooded with water to make sure that all gas has been expelled.

Where shops are piped for oxygen supply, and it is supplied from a number of cylinders manifolded it will probably be arranged for the same man who looks after the acetylene generator to look after the oxygen manifold and replace the exhausted cylinders with full ones when necessary.

A careful search should then be made for leaks, which will be detected by a hissing sound. Connections where leaks occur should be tightened immediately. If cylinders are found that leak around the valve stem, they should be disconnected and returned to the manufacturer. Under no circumstances should workmen be permitted to attempt any repair to the valves and valve fittings on an oxygen cylinder of any type or description. It is important that periodic tests be made of the working pressure gages on the regulators. These are the pressure gages that indicate the delivery pressure of gas from the regulator. As previously mentioned, acetylene should never be used in a blowpipe or in a hose or piping system at pressure over 15 pounds per square inch, and it is on this account that I emphasize the importance of making sure that the working pressure gages, particularly those on the acetylene supply, are periodically tested, to see that they register correctly.

Let us warn you against long hose of too small a diameter. A number of blowpipes function properly only when the acetylene is delivered to the inlet to the blowpipe at a pressure somewhere between 10 and 12 pounds to the square inch. It is found that if acetylene is compressed into a porous substance, and where the porosity does not exceed 80 per cent, the acetylene cannot be exploded or ignition propagated when the pressure is over 15 pounds per square inch, as it could be if the cylinder contained no porous mass. Therefore, a cylinder properly constructed and containing the proper porous mass can safely be used for the storage of acetylene at over 15 pounds pressure per square inch. Welders on heavy work should be supplied with fireproof gauntlets and aprons as a protection against radiated heat, and it is considered advisable where welding is being performed in the interior of some structures to insist that all outer clothing be fireproof. Welding must be used only where welding can be considered good and safe practice for construction and repair. Some users become overenthusiastic and attempt to employ welding on certain work where it should never be attempted and consequently fall down badly, with the result that it tends to give welding a bad name and creates a feeling of insecurity.

Locating the Foundry

Many foundries are incorrectly located according to Frank D. Chase, foundry engineer, Chicago, who spoke before the New England Foundrymen's association Feb. 13. Mr. Chase said that while

America was far ahead of England in the matter of foundry design considerable improvement in other lines must be had before anything like proper low cost production of castings can be achieved. He stated that in selecting a foundry site, labor supply, room for expansion, disposal of waste material, transportation of raw materials, and of the finished product are important features to consider. He took each of these different items and discussed the right and wrong method.

Having determined location, the next question to study is the layout and the proper flow of materials, he stated. A straight short easy flow of material through the plant from the raw to the finished product is the goal to be sought. Correct equipment, both in molding machines and auxiliary apparatus is essential, said Mr. Chase. His talk was illustrated with lantern slides showing various installations and detailed views portraying correct and incorrect methods.

Portable Ladle Drying Apparatus

BY HUBERT HERMANNS

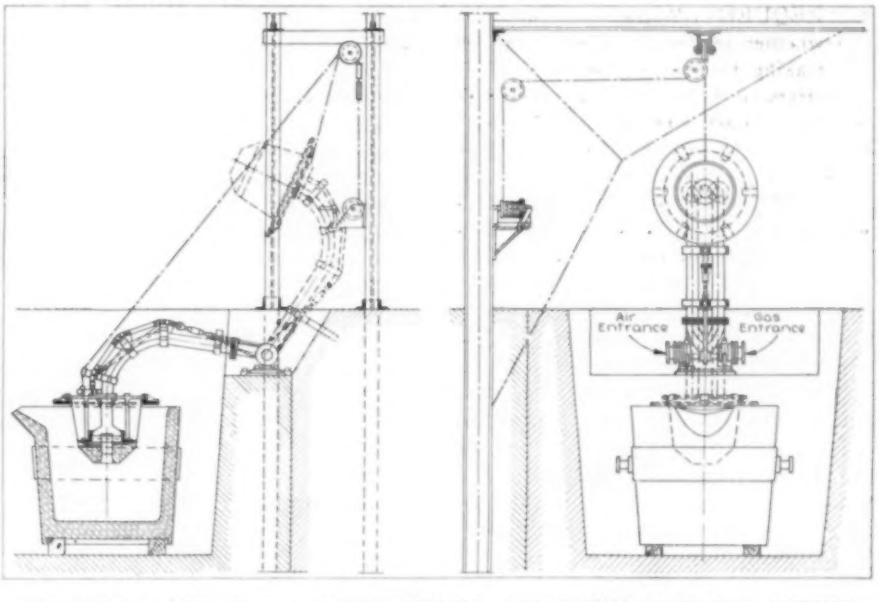
German Correspondent THE FOUNDRY

DRYING and heating ladles in steel foundries in which producer or natural gas is available generally is effected by that fuel. Such an apparatus is simple in construction and easy to handle and regulate. For burning the gas a brickwork burner inserted into a pit in the ground generally is sufficient, the ladles to be dried being put upside down upon the mouth of the burner. Such an apparatus has a drawback which becomes particularly noticeable during the drying period. The products of combustion, loaded with steam only can escape downward around the edge of the ladle. Gases have a tendency to ascend and, therefore, are baffled and compressed below the bottom of the ladle. In consequence of this an atmosphere saturated with steam is found under the inverted bottom of the ladle, which only slowly takes up the water evaporated during the drying process.

During the subsequent heating of the ladle to white heat the baffling and crowding of the hot gases underneath the bottom of the ladle is favorable, inasmuch as it enables a better utilization of the heat of combustion. Therefore, it is preferable to distribute the drying and heating of the ladle over two separate operations so that the drying is effected in such a manner that the gases saturated with steam escape upward, while for heating, the ladle is tilted over the burner and heated in the usual manner. The drying of the ladle, therefore, should take place from above with the ladle in its upright position.

In a German steel foundry this manner of operation has been employed with satisfactory results. When drying the ladle from above the burner must be so constructed, that the hot gases act well upon the ladle walls to be dried and the gases charged with steam are able to escape freely. For this purpose the burner must be made portable. The construction is shown in the accompanying illustration. It works with producer gas, but may be operated with blast furnace gas, coke oven gas or natural gas. The advantages of gas heating include the simple regulation and adjustment of the drying temperature ranging from a moderate drying heat at the commencement of the drying process up to the highest temperatures by simply throttling the current of gas.

The burner is attached to a bent pipe and is raised and lowered by a rope winch. The burner pipe communicates by a stuffing box with a gas and air supply pipe. The burner with the gas and air supply pipe can be handled easily.



FLEXIBLE COUPLINGS RENDER DRYING APPARATUS MOVABLE WITHIN UPRIGHT LADLE—DIRECT CONTROL PROVIDED

With the burner holder is combined a sheet-iron ring, which partly covers the ladle at the top. The gases charged with steam escape through the opening around the ring. They are obliged to pass along the walls of the ladle, so that the available heat is utilized to the best advantage. The mouthpiece of the burner is made of a molded refractory block, which is attached to the burner hood.

Gas and air enter from opposite sides and are conducted separately to the burner. The air is utilized to cool the large cavity of the burner. It flows into the burner through tangentially disposed passages. The gas channels in the burner likewise are disposed tangentially. The channels are arranged in such a manner, that gas and air channels alternate, so that a whirl of gas and air is set up which effects a perfect mixture. A loose guide wheel, situated between the annular gas and air channel may be adjusted according to the condition of the gas. The quantity of the air of combustion increases with the quality of the gas employed. The air channel, therefore, is narrowest for blast furnace and producer gas and correspondingly wider for coke oven gas and natural gas.

Pickling Solutions for Various Metals

By G. A. Drysdale

Question: Please advise us what process is necessary to pickle gray iron and brass castings and to remove core sand from small core holes in castings. We know nothing about this, and wish you would give us complete details.

Answer: Any one of three methods

generally is used for pickling gray iron castings.

Sulphuric acid, commercially known as oil of vitrol, is used in a solution made of 1 part acid to 8 parts water. The strength of the solution is governed by the individual working condition. The stronger the mixture, the more vigorous is the action. However, the best results are obtained with the more dilute acids.

Sulphuric acid acts in the following manner. The acid attacks the surface of the metal, loosening the adhering sand which falls away or is washed away from the casting. For this reason the parts cleaned should be subjected to the action of the acid only so long as is necessary to remove the sand, for otherwise the skin of the castings will be affected.

In preparing the sulphuric pickling solution, it is essential that the acid be added to the water slowly. Do not pour the water into the acid, as this generates heat rapidly and results in *spitting* when these two bodies are brought together.

Hydrofluoric acid pickle usually is made in the proportion of 1 of acid to 8 of water. This acid dissolves the adherent sand on the casting with practically no effect upon the metal. For this reason, the acid will not affect the surface of the castings if they are left too long in the liquid.

Hydrochloric acid, commercially called muriatic acid, is used as a pickling agent in the proportion of 1 part of acid to 10 parts of water. The action of this solution upon cast iron is similar to sulphuric acid. They both attack the metal and loosen the adherent sand.

It is essential that the pickling baths be replenished with acid from time to time to maintain the required strength. This may be regulated when hydrometer and thermometer readings indicate the need in fortifying the solution.

A satisfactory pickling solution for brass castings is nitric acid, diluted with 6 to 8 times its volume of water. In this solution, care must be taken not to leave the brass castings in the pickle longer than absolutely is necessary to remove the sand as this acid attacks the metal. A fumeless bright dip may be made of sulphuric acid 10 parts, saltpeter 2 parts and water 2 parts. Dissolve the saltpeter in the water and cautiously add the sulphuric acid.

To remove core sand from small core holes in castings the hydrofluoric acid pickle will be found safe and satisfactory.

After either brass or iron castings are taken from the pickling vats, they should be washed thoroughly in hot water and dried to eliminate all traces of acid.

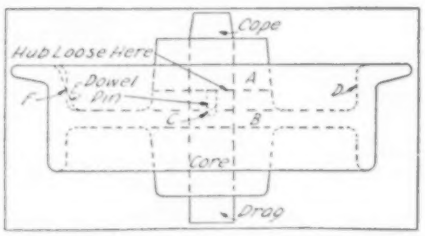
Pickling of both ferrous and nonferrous castings have to a great extent been supplanted by sand blasting, tumbling or cleaning in a wet mill.

Varnished Surface Check on Patterns

BY M. E. DUGGAN

FREQUENTLY the question arises whether or not it is good pattern-making practice to apply varnish to the bottom of loose pieces and the corresponding contact surfaces on the face of the pattern. In many instances probably it represents time and labor wasted. Varnishing that part of the pattern representing metal, one color, and the core prints and points where the cores cut through, another color, involves considerable work and in my opinion frequently is not necessary. However, occasions arise where the practice distinctly is to be commended for the additional check it supplies both in the foundry and the pattern storage vault. An incident coming under my observation recently furnishes a case in point.

One of the cranes was out of commission on account of two broken wheels and it was decided to make a pattern and have a set of wheels made in a local foundry rather than incur a delay of possibly ten days in having a set forwarded from the crane manufacturer. This was an emergency job and therefore instead of using a drawing, the patternmaker secured all the necessary data from a good wheel temporarily removed from the crane for the purpose. In the original wheel the inside of the rim was straight as shown at *D*, in the illustration. This feature was changed in the pattern as at *E*, to facilitate lifting the enclosed body of sand in the cope. The pattern was turned in the lathe in the usual manner and the cope hub *A*, was made separate and adjusted in place by a 5/8-inch dowel pin in the center. The cope core print instead of being nailed to the hub was doweled in place also with a 5/8-inch dowel pin. The pattern was given one coat of clear shellac varnish all over and the core prints were given one coat of black varnish. After the varnish had dried the pattern was rubbed down with fine sandpaper



THE COPE HUB AND THE COPE CORE-PRINT WERE PROVIDED WITH THE SAME SIZE DOWEL PINS, A FEATURE WHICH LED TO CONFUSION

and rushed to the foundry. The castings were made, machined and assembled on the crane and the pattern was laid away in the pattern storage.

Six months later it was decided to equip several cranes with steel wheels and the pattern was ordered sent to a steel foundry with an order for 16 castings. The pattern had been made in a hurry and there were no chisel marks, letters or figures stamped on either the body or the loose hub to indicate their relationship. These details were not considered necessary at the time the pattern was made because verbal instructions were passed to everyone who handled the job. The pattern was given a serial number

The man who was sent to the pattern loft for pattern 4-11-44 never had seen the pattern and naturally when he found a wheel with the required serial number lying in the proper shelf he had no suspicion that it might be in several parts. The pattern was painted the same color all over with the exception of the black core print on the drag side and when the man saw a cope print a short distance away with a dowel pin that fitted the dowel hole on the cope side of the pattern he assumed that he had the complete pattern. During the six months the pattern had been lying in the hot, dry pattern storage, the dowel pins had shrunken and the cope hub and cope core print had fallen off and rolled to one side. The pattern was taken to the foundry and not until the 16 castings arrived in the machine shop was it discovered that each wheel lacked the cope part of the hub. Thus 16 wheels were scrap, owing to the fact that the pattern was not painted and marked properly.

Sash Weights Molded in Variety of Ways

Question: We are studying the subject of sash weight molding and will appreciate any information you can offer.

Answer: Description of sash weight molding according to various methods

was published in THE FOUNDRY many times in recent years and a search through the back files will supply you with practically everything extant that has appeared on the subject. We particularly direct your attention to the following issues: April 15, June 1 and Aug. 1, 1921 and July 15, 1922. In the event that you do not have a complete back file the following description covers the subject briefly.

Sash weights are made under two conditions. In the first they are treated as a distinct line of castings and made on a production basis. In the second they are considered as *fillers*, to meet an occasional demand and to absorb any iron that may be left over each day after the regular heat has been poured. It readily is apparent that methods and equipment suitable under one condition are not appropriate under the other. However, some of the wholesale methods may be adapted or modified to suit retail conditions.

One foundry with an output of approximately 10 tons a day employs a battery of water cooled cast iron molds. The molds are set upright in a shallow pit and are hinged at one side to facilitate the removal of the castings. They are poured individually through the open top and the eye of the casting is formed near the bottom of the mold. On account of the almost infinite variety of sizes, this style of installation is comparatively expensive and only is justified by the heavy tonnage produced.

In a second foundry two sets of patterns are employed. The set consists of six pieces of steel pipe approximately 2-inch diameter and 30 inches long. These patterns may be adapted to make almost any weight by placing a stop-off plug in one end. The molds are made horizontally in a deep flask and the patterns are drawn through one end. In this manner six or eight sets of molds may be made in the one flask. A thin flat plate rammed vertically at one end serves for a common gate and, as stated previously, the plugs serve to close the other ends of the molds. The plugs also form the eyes and stamp the figure indicating the weight. In this connection it is interesting to note that DeVed Bros., Baltimore, have obtained a patent on one style of core employed for this purpose.

In a third foundry the patterns are mounted on a stripping plate and jolted on a machine. The patterns may be adjusted at any height above the stripping plate to produce castings of any definite weight. The flasks are removed from the machine, rolled over and placed on the floor. They may be poured with the tops open and with a core in the bottom of each one to form the eye, or they may be covered with a cope containing an individual runner leading to each mold and a loop designed to take the place of the usual eye at one end.

In a fourth foundry, ordinary split patterns are mounted on a matchplate and rammed on a squeezer machine. Satisfactory castings are made by each of the methods outlined and local conditions will influence a foundryman in his choice.

Elect New Officers

At an election held Jan. 23, the Eastern Malleable Iron Co., Naugatuck, Conn., effected a number of changes in personnel. Harris Whittemore was made chairman of the board. The other officers elected include the following: C. L. Berger, president; E. Mannweiler and John E. Walker, vice presidents; George B. Woolson, secretary and treasurer. The company operates malleable iron foundries at Naugatuck, Bridgeport and New Britain, Conn., Troy, N. Y., and Wilmington, Del.

Westinghouse To Build

The Westinghouse Air Brake Co., Wilmerding, Pa., plans to construct a new three-story building 915 feet long and containing 212,107 square feet of floor space to cost about $1,250,000. Half of this building, including three floors, will be used for foundry purposes. The remainder will be occupied by a machine shop. The entire third floor of the machine shop section and part of the second floor will be converted into a new department for the manufacture of automatic train control equipment. Bernard H. Prack is architect and Stone & Webster, Boston, are engineers. G. W. Wildin is general manager.

Addresses Foundrymen

J. Henry Scattergood, director of the American Dyewood Co., Philadelphia, addressed the meeting of the Philadelphia Foundrymen's association at the Manufacturers' club, that city, Feb. 13, on "Reparation in the Ruhr Deadlock and America's Opportunity." The Welsbach Co., Gloucester, N. J., represented by A. G. Hensel, shop manager, has been elected a member of the society.

Awards Plant Contract

The Wolff Mfg. Corp., Chicago, has awarded a contract to the Austin Co., Cleveland, to design and construct a new brick and steel enameling plant, 125 x 156 feet and costing $100,000. The Wolff company also has awarded a contract to the same company to remodel its building at the southwest corner of Robey and Fulton streets, now used as a storage warehouse, for use as a brass foundry and light machine shop.

Announce Prize Contest

The board of awards of the American Foundrymen's association has announced an Obermayer prize contest for 1924. The prize will be awarded to the person submitting a device, drawing or model of some jig or method which, in the opinion of the judges, embodies the best ideas for the economical production of castings. These exhibits, which will be on display at the annual convention, must be for a jig or piece of equipment that can be constructed in any foundry and used in the production of castings, in core making, molding, or handling operations. A condition to the contest is that all exhibits must be in the hands of the committee 30 days prior to the opening of the Milwaukee convention.

Make Heavy Machine Parts—I

(*Concluded from Page* 184)

large pieces of scrap which are too large for the cupola. The furnace is fired by a pair of automatic stokers made by the Jones Underfeed Stoker Co., Chicago, and is provided with movable bungs in the roof through which a crane may deposit large pieces of scrap on the hearth. The crane passes in and out through one end of the building. On account of the severe service the furnace only is fired on alternate days. On the second day necessary repairs are effected to the walls and roof and the bottom is made up for the following day.

Instead of tapping the iron into a ladle it is conducted through a long spout and poured into a pig bed on the floor similar to that in front of a blast furnace. After it has cooled the pigs are torn apart by the crane and conveyed to the stock yard. The scrap is analyzed before it is charged into the air furnace and before the iron is tapped it is treated with ferromanganese and ferrosilicon to conform closely to any desired analysis. Iron melted in this manner is reserved principally for rolls that are poured from low carbon iron.

Interesting features connected with the molding of two typical castings in this foundry will be described in the second installment of this article which will appear in an early issue.

THE FOUNDRY

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The Human Touch in Industry

TREND of recent thought among influential men responsible for the conduct of large industrial enterprises, seems to indicate that the human element is receiving more consideration and the importance of securing and holding the loyalty of the rank and file is regarded as the basis of an efficient organization. To a certain extent the motive may be regarded as selfish, since the ultimate object is to secure greater returns, but when one considers that every individual connected with the organization shares in the increased prosperity, the charge of selfishness on the part of the promoters largely is discounted.

The movement that has been gathering way steadily may be regarded as the backward swing of the pendulum that was given an impetus in the opposite direction some 25 years ago by management plans that disregarded the individual. Efficency was paramount, and systems which considered this element, alone

Time and motion studies where applied scientifically to increase efficiency have many commendable features and have been responsible for gratifying results when operated by men who have made a life-long and intensive study of the subject. Applied elsewhere, under other conditions and under the supervision of men without adequate training or experienced and without the slightest conception of the workman's viewpoint, they frequently met with indifferent success and in many cases with dismal failure.

The analogy does not hold strictly all the way through, but the broad general principles voiced by the late Robert G. Ingersoll in his widely known address "Dead Empires" has a pertinent bearing on the subject. The address was delivered 40 years ago, but the recorded words are as alive and vivid today as they were when thousands were thrilled by the famous orator when he said:

"The traveler standing amid the ruins of ancient cites and empires and seeing on every side the fallen pillars and the prostrate walls, asks why did these empires crumble and why did these cites fall? And the ghost of the past, the wisdom of the ages answers: These temples, these palaces, these cities, the ruins of which you stand upon, were built by tyranny and injustice. The hands that built them were unpaid. The backs that bore the burdens also bore the marks of the lash. They were built by slaves to satisfy the vanity and ambitions of thieves and robbers. For these reasons they are dust.

"Their civilization was a lie. Their laws merely regulated robbery and established theft. They bought and sold the bodies and the souls of men, and the mournful winds of desolation, sighing amid their crumbling ruins, is a voice of prophetic warning to those who would repeat the infamous experiment, uttering the great truth, that no nation founded upon slavery, either of body or mind, can stand."

The situation is epitomized in a remark attributed to an Italian laborer who wanted to return to the United States after having served with the colors of his native land during the war. "Me," he said. "I work da squeeze machine ina da found'. Every morning da boss coma downa da gangway—not da little boss, da bigadaboss—an' he wave his han' to me. just lika dat, and he say 'Hello Mike!' By dam' you bet my life I lika work fo' dat man!"

Trade Outlook in the Foundry Industry

FEBRUARY has marked an increased impetus in industrial lines. This state was reflected in increased sales of machinery and equipment, in orders for raw materials and inquiries and definite contracts for a wide variety of commodities. The foundry industry has kept step in this general advance. Malleable operations have increased. Steel castings orders have grown. Automobile manufacture has brought specifications against existing contracts to cylinder and miscellaneous jobbing shops. Implement castings output has grown and general jobbing foundries have noted an increased demand for their products.

Railway Prospects

Difference of opinion is apparent with regard to the outlook for railway car and locomotive orders for the current year with the reflex effect upon the demand for railway specialty castings. Car inquiries and actual contracts for rolling stock of all classes have shown a quickening impulse toward the close of February. The New York Central placed 8000 cars with two builders during the week of Feb. 18, while specifications for 8000 box cars, and 4000 freight cars of other classifications were made by the Pennsylvania in the same week. Western and southern roads have been buying in lots of from 500 to 2000 cars. Estimates hold that a total of over 50,000 cars still are pending. This activity indicates the basis of belief for one side of the argument. Against this, is offered slight decreases in revenue freight loadings, the continued high effciency of operation and the low figure of bad order cars reported. These factors seem to indicate a less urgent demand for railway equipment this year than was encountered in 1923 One large maker of railway specialty castings estimates the 1924 requirements at 80 per cent of last year's orders.

Prices for Raw Materials for Foundry Use

CORRECTED TO FEB. 22

Iron		Scrap	
No. 2 Foundry, Valley	$25.00 to 26.00	Heavy melting steel, Valley	$21.00 to 21.50
No. 2 Southern, Birmingham	22.50 to 23.00	Heavy melting steel, Pitts.	20.50 to 21.50
No. 2 Foundry, Chicago	24.50	Heavy melting steel, Chicago	18.00 to 18.50
No. 2 Foundry, Philadelphia	23.76	Stove plate, Chicago	19.50 to 20.00
No. 2 Foundry, Buffalo	22.00 to 23.00	No. 1 cast, Chicago	23.00 to 23.50
Basic, Valley	22.00	No. 1 cast, Philadelphia	19.50 to 20.50
Basic, Buffalo	23.00	No. 1 cast, Birmingham	19.50 to 20.00
Malleable, Chicago	24.50	No. 1 cast, Buffalo	20.00 to 20.50
Malleable, Buffalo	22.00 to 23.00	Car wheels, iron, Pittsburgh	21.00 to 21.50
Coke		Car wheels, iron, Chicago	21.50 to 22.00
Connellsville foundry, coke	$5.00 to 5.50	Railroad malleable, Chicago	22.50 to 23.00
Wise county foundry, coke	5.75 to 6.50	Agricultural mal., Chicago	20.50 to 21.50
		Malleable, Buffalo	22.00 to 23.00

Automotives Active

Prospective automotive needs continue to furnish the giant enigma of the castings market. Production of all classes of automobiles increased in January. The total given by the automobile chamber of commerce is 341,000 passenger automobiles and trucks manufactured in the first month of the year. This exceeds the December total by 15 per cent and that of January, 1923 by almost 40 per cent. Sales have been stimulated by the automobile show season bringing slight changes and refinements which attracted purchasers. Further, the easy-payment, long-time credit, sales plans in use by many manufacturers have served to stimulate buying. However, the present rate of production is believed to to be ahead of the actual sales, and dealers' stocks are increasing. This condition is welcomed by many sales agencies that remember the loss encountered through deferred deliveries last year. Truck sales are the most active ever reported for the winter season, reflecting the general industrial activity and the consequent increased demand for haulage. Brightening prospects in rural communities have bolstered up sales in those districts in passenger cars, trucks and tractors. Automotive foundries are operating on a high schedule rate.

Diversified Demand

No single branch nor classification may be characterized as excelling in foundry activity. Malleable operations in general have improved, but the improvement in automobile, electrical and agricultural implement lines has been coincident with decreased demand for railway castings. The greatest increase has been marked in the case of malleable castings for agricultural machinery. Steel castings bookings increased from 42.4 per cent of capacity in December to 50.7 per cent in January. Contrary to experience in the malleable industry, the orders for railway steel castings increased from 39.6 per cent of capacity in December to 49.5 per cent in January, according to a report of the department of commerce, covering statements from 65 companies. In the Pittsburgh district, steel foundries report decreased demand for their products. Cast-iron pipe sales continue at a high rate from southern foundries, and in the east, while municipal buying is slackened, private and miscellaneous demand serve to maintain full time operation of pipe shops. Soil pipe and fittings foundries are busy. Radiator and furnace plants are active. January foundry operations in Ohio showed marked improvement according to a report of the Ohio State Foundrymen's association. The actual melt figured for January is given as 74.4 per cent of capacity as compared with 57.6 per cent for December and 59 per cent for January, 1923. Stocks of materials on hand decreased from 93.6 per cent in December to 85.2 per cent in January.

Nonferrous Activities

Brass foundries are busy. In Ohio, according to the report of the state association, nonferrous operations declined from 68.3 per cent in December to 63.5 per cent in January. German nonferrous scrap has made its appearance in eastern markets and some quantities have been purchased by plumbing goods shops. New York prices on nonferrous metals, according to quotations in the *Daily Metal Trade* of Feb. 22, follow: Casting copper, 13.12½c; electrolytic copper, 13.20c; Straits tin, 54.50c; lead, 9.37½c; antimony, 11.12½c to 11.25c; nickel, 32.00c; aluminum, No. 12 alloy, open market, 23.75c to 24.25c. Zinc is 6.85c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

MICHAEL R. BURNS, who for the past 28 years has been with Isaac G. Johnson & Co., Spuyten Duyvil, N. Y., has become connected with Eagen-Rogers Steel & Iron Co., Crum Lynne, Pa. Mr. Burns for the past 15 years has been general foundry foreman for the Isaac G. Johnson company. The latter firm has discontinued operations and the plant is being dismantled to make way for straightening the Harlem ship canal, as was noted previously in THE

MICHAEL R. BURNS

FOUNDRY. Mr. Burns had charge of pouring the last heat of steel that was made in that historical shop.

Charles Elliot has been made foreman of the Washington Stove Works, Everett, Wash.

J. C. Mead, at present clerk of the circuit court at Oregon, Ill., will join the Paragon Foundries Co., that city, as assistant superintendent.

S. Wells Utley, vice president and general manager of the Detroit Steel Castings Co., Detroit, has been re-elected president of the Employers' Association of Detroit.

J. H. Hogue, for the past five years superintendent of the foundry of the French Foundry Co., Piqua, O., has accepted a position with the Turner & Seymour Mfg. Co., Torrington, Conn.

Frank D. Taggart, formerly superintendent of the roll foundry of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has been appointed superintendent of the steel roll department of the National Roll & Foundry Co., Avonmore, Pa.

H. P. Parrock, who has had 18 years experience in foundry work at the Youngstown Foundry & Machine Co., Youngstown, O., the Lumen Bearing Co., Buffalo, and the Draper Corp., Hopedale, Mass. has established an office as consulting engineer at 131 State street, Boston.

Dr. Albert Sauveur, professor at Harvard university, has been awarded the Bessemer gold medal for 1924 by the Iron and Steel Institute of Great Britain. The presentation of this medal will be made at the May meeting of the society in London. Mr. Sauveur is the sixth American to be thus selected, Dr. Henry M. Howe having received this distinction 29 years ago.

C. W. Eger, managing director Elektrokemisk Industri, Norway, with his metallurgical adviser Dr. M. Sem, is in the United States negotiating with companies interested in the use of a continuous self-baking electrode for electric furnace practice. The Electric Furnace Construction Co., 1015 Chestnut street, Philadelphia, is American representative for this type electrode.

John P. Frey, editor of the *International Molders' Journal*, has been elected president of the National Bureau of Economic Research. The purpose of the bureau is to carry on scientific investigations in connection with industrial phenomena for the use of those who desire facts which as yet have not been satisfactorily examined and analyzed. The bureau already has produced two studies, one on the distribution of income in the United States and the other on cycles of employment.

Frank Everitt, for seven years supervising engineer with Miller Franklin Basset & Co., New York, resigned Jan. 1 to become associated with the American Radiator Co., Buffalo. Mr. Everitt became associated with the J. L. Mott Iron Works, New York, in 1899, serving as one of their plant superintendents until 1914 when he was connected with the Trenton Potteries Co. He has been active in the work of the American Foundrymen's association. Previously he was secretary-treasurer of the Foundry Foremen's association, and directed his activities in part to the formation and organization of many branch associations.

From the Sand Heap to Royal Palace

From the sand heap to royal chamberlain in the most aristocratic of European courts is the romantic history of John E. Davison, an English molder, who has just been appointed vice chamberlain of the King's household in Great

JOHN E. DAVISON

Britain. For 21 years Mr. Davison worked in iron foundries in Great Britain at his trade as a molder. Afterwards he became qualified as a sanitary inspector but was soon drawn back into the foundry field, several years ago becoming an organizer for the Friendly Society of Ironfounders, of which he is now vice president. The association is the leading trade union in the foundry field in Great Britain. During the war Mr. Davison was a member of the trade union advisory committee of the ministry of munitions and the iron and steel committee of the board of trade.

His new appointment is a result of the curious anomaly of a labor-socialist government functioning in a royalist and aristocratic country. In position, Mr. Davison ranks next to the lord chamberlain. In addition to licensing theaters and censoring plays, the lord chamberlain's office regulates all the official social routine at the various royal pal-

aces. The office also keeps a register of patents of nobility and other documents dealing with the perpetuation of the hereditary system. In 1624 an iron molder who mixed in politics would have been lucky to avoid an introduction to the official headsman; but in 1924 the spectacle of a union molder turned courtier excites no comment in the royal palaces of Great Britain.

Foundrymen To Meet in Milwaukee Oct. 13-16

Announcement has been made that the twenty-eighth annual convention and exhibition of the American Foundrymen's association will be held in Milwaukee, Oct. 13-16. In selecting the convention city the board of directors gave consideration to the demand for a location that would be convenient to foundrymen living in the middle and far west. This will be the first convention of the association held west of Ohio since 1918 and the second since 1914. Milwaukee is the sixth city in the United States in point of number of foundries and ranks among the first in the extent and character of foundry activities.

As in 1918, Milwaukee's municipal auditorium will be the center of activities. This large building has accommodations for exhibits, general and sectional meetings, all under one roof. It is proposed to hold a four-day meeting, Monday to Thursday inclusive. The exhibit will open the preceding Saturday, as in Cleveland last year, making Saturday, Oct. 11, Milwaukee day, but will not be open on Sunday. Detailed information including the program of section meetings will be announced later.

Change Sales Personnel

Howard MacNeal, formerly of the Philadelphia plant of the Link-Belt Co., has been transferred to the Chicago plant of that organization where he will have charge of promotion of portable loaders, portable belt conveyors and electric hoists.

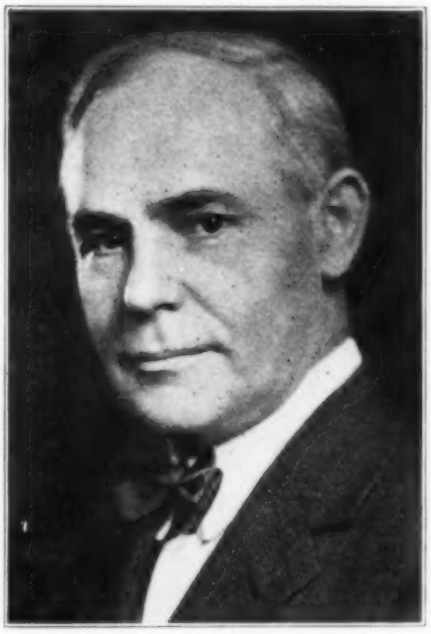
C. S. Huntington, sales engineer in charge of the sand and gravel washing division of the same company has been appointed as representative of the cement interests of that company in addition to his former duties. He will continue to maintain his office at Chicago.

Robert T. Harris, who has been located at the New York office of the Blaw-Knox Co., has been transferred to Baltimore as assistant sales manager.

Metallurgist Joins The Foundry Staff

George A. Drysdale has been made metallurgical editor of THE FOUNDRY succeeding the late H. E. Diller. Mr. Drysdale has had 26 years experience in practical foundry and metallurgical work, following his graduation from college in 1898, and is widely known through his writings on technical subjects.

Mr. Drysdale was born in Swansea, S. Wales, England, in 1873, and emigrated to Boston with his parents in 1883. He received his primary education in the public schools of Chelsea, Mass., later attending the collegiate school and university of Kings College, Nova Scotia. He entered McGill university, Montreal, Canada, with advanced standing and was graduated from that institution with the degree of bachelor of applied science, in 1898. Later, the same university conferred the degree of master of science in recognition of his attainments in practical chemistry and metallurgy.



GEORGE A. DRYSDALE

His first employment was with the Howard & Bullough American Machine Co., Pawtucket, R. I., where he was foundry chemist, in addition to serving a practical apprenticeship in the different departments of the foundry. He left the New England company in 1903 to become metallurgist for the Stover Mfg. Co., now the Stover Mfg. & Engine Co., Freeport, Ill. Later he ran this shop on contract as foundry foreman.

In 1907, Mr. Drysdale was engaged to demonstrate foundry coke for Baird & West, selling agents for the Solvay Process Co., Detroit, traveling through the Detroit district in the United States and Canada. When a position as head of the raw material inspection department of the International Harvester Co., of Canada, Ltd., Hamilton, Ont., became available, Mr. Drysdale became connected with that firm and also was given supervision of the chemical and physical laboratories, remaining in Canada until 1911, when he accepted the position of chemist and metallurgist for the Atlas Engine Works, Indianapolis. In connection with his work at this plant he demonstrated the possibility of using domestic iron for the manufacture of sleeves for the Lyons Knight automobile. This previously had been thought impossible due to the severe specification requirements.

Mr. Drysdale left the Atlas company in 1912 to engage in research work for the Ingersoll-Rand Co., Phillipsburg, N. J., on malleable iron, especially the European, white-heart varieties. He returned to the Atlas Engine Works, reorganized as the Lyons-Atlas Co., and later the Midwest Engine Corp., Indianapolis, in 1913 and was continuously employed by that company and its associate, the Hill Pump Works, Anderson, Ind., until he took up his work with THE FOUNDRY, Feb. 1, 1924.

Obituary

Daniel M. Buck, aged 46, metallurgical engineer of the American Sheet & Tin Plate Co. for the last 10 years, and connected with the company for 17 years at New Castle, Demler and Pittsburgh, died Jan. 23 at Vandergrift, Pa. He was born in Greenville, Pa. Mr. Buck was a leader in many technical research investigations in the iron and steel industry.. Among his investigations were researches in corrosion and the development of copper in steel as a rust resistant influence.

Henry S. Burkhardt, aged 81, until 1912 assistant manager at Chicago of the National Malleable Castings Co., died Dec. 29 at Chicago. Mr. Burkhardt was in the implement business in Louisville when, in 1874, he became associated with the Chicago Malleable Iron Co. ,Chicago, as sales agent. He continued in this capacity until 1883 when he was elected vice president in charge of sales. When the Chicago Malleable Iron Co. was consolidated with the Cleveland Malleable Iron Co., the Indianapolis Malleable Iron Co. and the Toledo Malleable Iron Co. under the name of the National Malleable Castings Co., he was elected assistant manager at Chicago.

Industrial Truck Features Long Wheel Base

A truck having a long wheel base has been added to the line of trucks manufactured by the Terminal Engineering Co., Inc., New York. This truck has a capacity of 5000 pounds, and is intended for carrying bulkier materials than may be handled on the shorter models.

The drive and handling features are identical with those of the shorter types built by this company. Each of the four wheels is driven by an individual, enclosed motor. It is stated that steering with the four wheels allows the truck to be turned in a short radius, although the wheel base is 91 inches. Brakes of the internal expanding type are provided on two of the wheel units.

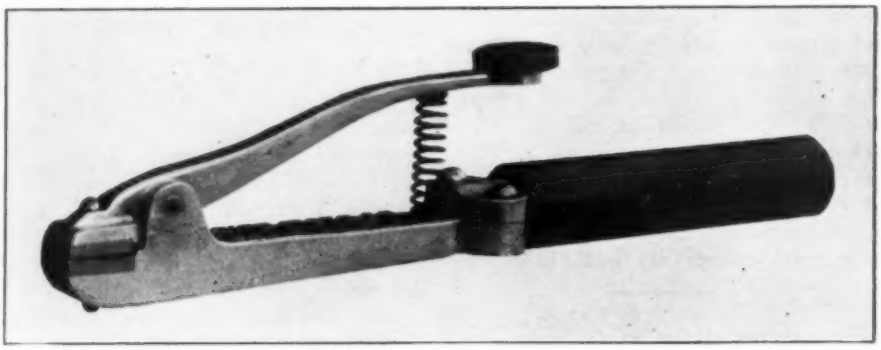
The truck is designed to use separate bodies, driving under them as they stand on legs, and picking them up by four, screw motor-operated jacks. A spring drawhead is supplied with the machine so that it may be used as a tractor. The coupler is automatic with a release governed from the operators position.

Flow Meter Is Operated by Electricity

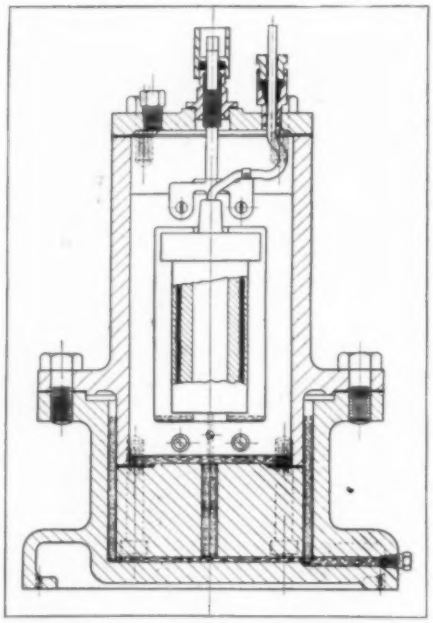
For accurate measurement of the total flow of steam, water, air, gas, oil, etc., the General Electric Co., Schenectady, N. Y., has introduced an electrically operated flow meter. This meter consists of three principal elements, namely the differential pressure producing device, the cast iron meter body piped to the differential pressure producing device and the electrical measuring instruments mounted on a panel.

In one leg of the cast-iron meter body, which is constructed in the form of U-tube, is a coil through which the current flows in its path through the meter body and back to the panel. As the differential pressure increases, mercury is forced up around this coil, acting as a secondary circuit inducing more current in the primary. This increase in current is indicated on the electrical instruments, and as the differential pressure bears a definite relation to the flow, the current shown on the instrument also will bear a definite relation to the flow.

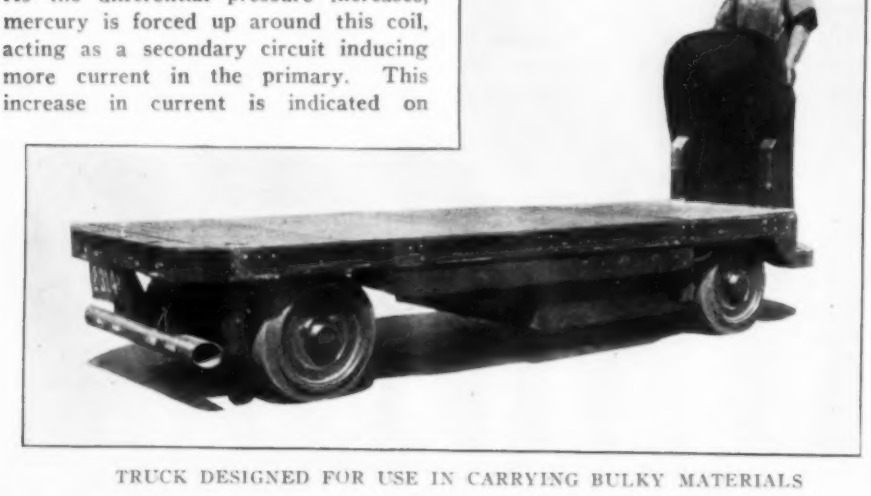
A small transformer on the outside meter body reduces the voltage applied to the internal transformer and acts as an insulating transformer. The adjustable line resistance, voltage regulator resistance and electrical measuring instruments are in series with the primary of this transformer. When properly calibrated, the electrical instruments will measure accurately the height of mercury in the small leg of the U-tube containing the internal transformer.



ELECTRO HOLDER HAVING RENEWABLE COPPER JAWS



SECTIONAL VIEW OF ELECTRICALLY OPERATED FLOW METER



TRUCK DESIGNED FOR USE IN CARRYING BULKY MATERIALS

Invents Electrode Holder

The Gibb Instrument Co., Bay City, Mich., has applied for patents on an electrode holder used in connection with automatic, semiautomatic, arc, spot, butt and seam welding electric welding machines. This device it is claimed will prevent the electrode holder from heating and thus inspire continuity of operation without any delay incident to waiting for the holder to cool. Use of material of high conductivity is responsible for the increased efficiency of the new holder. Renewable jaws are provided to meet the contingency incident to operation. Frequently the electrode is used to the last fraction of an inch and an arc is drawn on the holder. Again the wire sometimes slips and arcs between the jaws. The device is made of aluminum renewable copper jaws, is provided with a fiber handle and a fiber thumb piece and weighs 15 ounces.

Start Organization of Welsh Branch

Steps are being taken to organize a new branch of the Institute of British Foundrymen in South Wales with headquarters at Cardiff. It will be the tenth branch of the society. An organization meeting which was held Jan. 26 was largely attended. James Ellis who was president of the Institute of British Foundrymen in 1916-17, occupied the chair. The meeting was attended by W. G. Hollinworth, general secretary, and by a large number of Welsh foundrymen. J. J. McClelland, Whitchurch, Cardiff, read a paper on the shrinkage and warping of iron castings.

Varied Interest Encountered

Light Molding Machine Sales Are Increasing—Demand for Ladles, Flasks and Miscellaneous Sundries Indicates Revamping Existing Facilities Against Spring Needs

INQUIRIES for foundry equipment are varied as to the character of foundries depending upon the class of work handled, geographical location of source and the kind of foundry service for which new or replacement machinery is desired. Sales of cleaning room requirements have been large. Ladle shipments indicate a period of preparation for anticipated increases in foundry operations. Light molding machine demand is satisfactory. The Superior Brass & Copper Foundry, 531 St. Joseph street, New Orleans, is inquiring for a brass melting furnace. The West Steel Castings Co., Cleveland, has installed a core oven burner system made by the Mayor Fuel Saving Furnace Co. The Ryder Brass Foundry Co., Bucyrus, O., and the May Fieberger Furnace Co., Newark, O., have ordered sand-blast installations from the Pangborn Corp., Hagerstown, Md. Acme Foundry Co., Detroit, the Superior Iron & Mfg. Co., Wasseon, O., and Burnham Boiler Corp., Irvington, N. J., have ordered batch type sand mixers from the Standard Sand & Machine Co., Cleveland. Recent sales of dust-arrester equipment by the W. W. Sly Mfg. Co., Cleveland, include installations for Manitoba Steel Foundries, Ltd., Selkirk, Man., Canada and Gray Dudley Mfg. Co., Nashville, Tenn. General Foundry & Machine Co., Peoples Bank building, Pittsburgh, is in the market for foundry equipment, tools and electrical machinery.

New England Sees Improvement

RECENT demand for foundry equipment throughout New England has taken a decided turn for the better. Inquiry is widespread and the buying of the past two weeks has been heavier than for any similar period since early fall. The Saco-Lowell Shops bought eight sand separators from the Royer Foundry & Machine Co., Wilkesbarre, Pa. The General Electric bought a miscellaneous lot of equipment for its Everett, Mass., plant. This purchase included a 25-ton electric traveling crane from the Chesapeake Iron Works, Baltimore, Md. The pipe making equipment of the Palmer Foundry, Palmer, Mass., has been purchased by a Worcester Mass., foundry which contemplates buying additional equipment and starting the manufacture of cast iron pipe. The Sullivan Machine Co., Claremont, N. H. has ordered a sand blast installation and the Worthington Pump & Machine Co., dust exhauster equipment from the Pangborn Corp., Hagerstown, Md. Recent sales of tumbling mill equipment by the W. W. Sly Mfg. Co., Cleveland, include units to the H. & B. American Machine Co., Pawtucket, R. I. and Davis & Furber Machine Co., N. Andover, Mass.

Eastern Demand Decreased

FOUNDRY equipment business in the eastern district tapered off in the last weeks of February. Considerable business is under contemplation, but orders have been scattered. A sizable buyer has been the Eagle Bronze Co., Mt. Vernon, N. Y., which is building a new foundry and recently closed on a 5-ton handpower crane, and 6 furnaces to the Whiting Corp., Harvey, Ill. It also has purchased other equipment, not yet announced. Another buyer of conveying equipment is the Flockhart Foundry Co., Newark, N. J., which has purchased a 5-ton electric crane, with 47-foot span, from the Pawling & Harnischfeger Co., Milwaukee, and the Richardson & Boynton Furnace Co., Dover, N. J., which has purchased some yard equipment. M. W. Kellogg Co., Jersey City N. J., has ordered a 5-ton electric crane, 27-foot span, from the Milwaukee Electric Crane & Mfg. Co., Milwaukee. The Hart & Crouse Co., Utica, N. Y., has acquired a used 23-ton McMyler-Interstate locomotive crane from Philip T. King, 30 Church sereet, New York City, for use in its yard. Tumblers and sand cutters are moving perhaps most actively of all items at present. While one large seller of this latter equipment has stated that business the past couple of weeks has not been as heavy as it was, demand for this type of equipment was still better than for the other lines handled. The Hershey Machine & Foundry Co., Manheim, Pa., is contemplating an addition. The requirements of the Standard Sanitary Mfg. Co., for its new Baltimore plant continue to engage the interest of sellers. The Singer Mfg. Co., New York, has purchased tumbling mills from the W. W. Sly Mfg. Co., Cleveland. J. L. Mott Co., Trenton, N. J. and the American Radiator Co., Buffalo, have orders for sand blast equipment with dust arrester equipment from the Pangborn Corp., Hagerstown, Md., while the American Malleables Co., Lancaster, N. Y., has ordered a sand blast barrel from the same manufacturer.

Note Varied Interest in Pittsburgh Area

WHILE in some directions foundry equipment sales in the Pittsburgh area have fallen short of what they were expected to be by this time, in others they have been well sustained. The inquiry rate never was heavier; numerous interests are seeking prices on equipment against planned expansion and revamping of foundry layouts this coming spring. At the moment, most of the attention is centered upon larger equipment, cupolas, tumbling barrels, molding machines, etc., since many foundry operators have not yet reached the smaller equipment in their considerations. However, a few sales of flasks, riddles, wheelbarrows, etc., are made from week to week as pressing needs occur. One inquiry is current here from the Hughes Tool Co., Houston, Tex., for a 5-ton electric traveling crane as well as an electric furnace for a steel foundry. The Standard Sanitary Mfg. Co., continues to tabulate bids for various kinds of foundry equipment, including six 5-ton cranes for its new Baltimore plant and probably will buy within two weeks. It closed this past week on an 88-inch cupola with the Whiting Corp., Harvey, Ill., for its New Brighton, Pa., plant. Other cupola buyers from this same builder are the following: Republic Boiler & Radiator Co., Baltimore; National Cast Iron Pipe Co., Birmingham, Ala. Tumblers, trucks, ladles, etc., were bought by the Haynes-Langenberg Co., St. Louis. Six tumbling machines were bought by the American Stamping Co., Chicago; two by the Lindgren Foundry Co., Baltimore; one by Venango Mfg. Co., Franklin, Pa.; one by the H. S. Lee Foundry & Machine Co., Plymouth, Mass.; and one by the Fairbanks-Morse Co., Chicago. The Whiting Corp. sold eight of its brass furnaces to the Great Western Smelting & Refining Co., and ladle equipment to the G. B. Morris Foundry Co., Cincinnati; Lynchburg Foundry Co., Lynchburg, Va.; General Electric Co., West Lynn, Mass., and the Lakey Foundry & Machine Co., Muskegon, Mich. Four or five large interests are getting flasks ready and are expected to make some large

installations of molding machines at an early date. The largest order recently placed with the Herman Pneumatic Machine Co. is that of the American Radiator Co., Kansas City, Mo., for four warehouses. Two each were ordered by the Indiana Foundry Co., Indiana, Pa., and the Weiskittle & Son Co., Baltimore, while the following bought one each: National Foundry Co., Erie, Pa.; Crane Enamel Ware Co., Chicago; Pacific Sanitary Co., Richmond, Cal., and the Franklin Foundry Co., Franklin, Pa. Carlisle Foundry Co., Carlisle, Pa., has ordered sand blast equipment and the Pressed Steel Car Co., Pittsburgh, a sand blast cabinet with dust arrester installation from the Pangborn Corp., Hagerstown, Md. The Columbia Sanitary Mfg. Co., Louisville, Ky., has purchased tumbling mills from the W. W. Sly Mfg. Co., Cleveland.

Sales Lighter in Chicago District

SALES of and inquiry for foundry equipment continues rather light in the Chicago district and are not up to the expectations held out for the opening months of 1924. The Beardsley & Piper Co. has placed one each of its motive type sandslingers with the American Steel Foundries, Indiana Harbor, Ind., and the American Manganese Steel Co., Chicago Heights, Ill., two tractor machines with the Central Foundry Co., Holt, Ala., and one portable machine with the Ford Motor Co., Detroit. In its export division it has closed for one of its tractor types with Metters, Ltd., Sydney, Australia. The National Engineering Co. has taken orders for one sand mixer each for the Auto Specialties Co., Windsor, Ont., Dayton Malleable Iron Co., Ironton, O., and the Studebaker Corp., South Bend, Ind. Recent sales of the Whiting Corp., Harvey, Ill., include one cupola each to the Seybold Machine Co., Dayton, O., and Sparta Foundry, Sparta, Mich. This company has sold a battery of tumbling mills to the Terre Haute Malleable Iron Co., Terre Haute, Ind., and four pneumatic, cupola chargers to the Singer Mfg. Co., Elizabethport, N. J. The Ford Motor Co., Detroit and Novo Engine Co., Lansing, Mich., have ordered tumbling mills from the W. W. Sly Mfg. Co., Cleveland. Recent sales of the Pangborn Corp., Hagerstown, Md., include sand separator equipment to the Bucyrus Co., South Milwaukee, dust arrester installations to Fairbanks Morse & Co., Three Rivers, Mich and H. Mueller Mfg. Co., Decatur and sand blast equipment to Joseph N. Smith & Co., Detroit.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Rhode Island Malleable Iron Works, Hill's Grove, R. I., operator of malleable iron foundry, plans constructing new foundry.

Williams Foundry & Machine Co., Akron, O., has increased its capital stock from $100,000 to $500,000.

Monroe Steel Castings Co., Monroe, Mich., has resumed full operations in its plant recently damaged by fire.

Southern Iron Works, South Jacksonville, Fla., contemplates a new plant on which construction is to begin shortly. The company makes gray iron, brass and aluminum castings.

Anniston Foundry Co., Anniston, Ala., has plans under consideration for rebuilding a portion of its plant recently damaged by fire.

Central Foundry Co., Anniston, Ala., will replace its plant and equipment recently damaged by fire. E. P. Cooper is manager. The company operates a gray iron foundry.

The Aluminum Foundry Co., Cincinnati, has been incorporated for $2500 by E. Albrecht, E. B. Albrecht, S. D. Kaefer, John Kaefer and H. L. Albers.

Foundry Products Co., Los Angeles, plans constructing plant at Fifty-fifth and Alameda streets. Company will produce malleable iron products.

Merchants Foundry Co., Oakland, Cal., has been incorporated for $75,000 with 750 shares of stock to conduct general foundry business.

Kensington-Davis Corp., 144 Kensington avenue, Buffalo, N. Y., has obtained permission to construct $125,000 1-story foundry addition. Building operations are to start immediately.

Simplicity Engine & Mfg. Co., Port Washington, Wis., has changed its name to Simplicity Mfg. Co., and will abandon gas engine production and conduct a general foundry and machine shop business.

The Fulton Co., Knoxville, Tenn., W. M. Fulton, president, plans the purchase of additional equipment for a $50,000, 2-story, 60 x 144-foot plant addition now under construction. The company manufactures temperature regulators and valves and operates gray iron and brass foundries.

Advance Aluminum Die Casting Co., 3925 Fort street west, Detroit, has had the Security Trust Co., that city, appointed as receiver. Sale of property as going concern will be sought.

Gilliam Mfg. Co., 820 Savannah avenue, northeast, Canton, O., plans addition to its plant. The company manufactures taper roller bearings and operates malleable iron foundry. B. T. Steiner is president.

The Ohio Brass Co., Mansfield, O., recently bought a 5-acre site and some buildings across the Pennsylvania railroad tracks from its present location. The company operates malleable, brass and aluminum foundries.

Pacific Stove & Range Co., Seattle, organized by W. H. Mackey, formerly with Washington Stove Works, Everett, Wash., and T. H. Eggers, plans establishment of foundry at Idaho and Dwamish streets, Seattle.

Statter Metal Co., 952 Hanna building, Cleveland, is constructing a foundry building at 7700 Bessemer avenue at a cost of $40,000 including equipment which has been purchased.

Jenkins Machine Co., Sheboygan, Wis., plans 1-story, 40 x 75-foot, brick and steel foundry addition to cost about $40,000. The company builds machinery for furniture factories and operates a gray iron foundry.

Wolff Mfg. Corp., 225 North Hoyne avenue, Chicago, has awarded contracts to the Austin Co., Cleveland, for constructing $100,000, 125 x 156-foot enameling plant. Remodeling of the storage warehouse for use as a machine shop and brass foundry is contemplated.

Hughes Tool Co., Houston, Tex., has awarded contracts for an 80 x 120-foot sheet steel, $75,000 foundry. Among equipment to be installed are a 5-ton electric crane and an electric furnace. H. W. Fletcher is chief engineer.

Tennessee Coal, Iron & Railroad Co. will increase its steel foundry capacity this spring at Fairfield, Ala., according to announcements by Gordon Crawford, president. Extension plans include expansion for production of castings for commercial purposes.

The Marchant Calculating Co., Powell and Landregan streets, Oakland, Cal., plans 1-story foundry costing about $50,000, building to be erected at Tenth avenue near High street. The company now operates gray iron foundry at Emeryvills, Cal.

Wheeler Condenser & Engineering Co., Carteret, N. J., has started work on the construction of a 100 x 245-foot foundry for the production of iron and brass castings. The company makes gray iron, brass and aluminum castings.

Francis H. Richards, New York, has been incorporated with 250 shares no par value common stock to operate a pattern and machine shop, by Francis H. Richards, F. J. Dole, and J. F. Humphrey, with G. Drewe, 15 Murray street, as attorney.

The Bowler Foundry Co., 1688 Columbus road, Cleveland, plans constructing 1-story, 200 x 500-foot foundry on Newburgh street along the tracks of South Shore railroad. J. H. Bruce is president and E. McGeorge, Stuyvesant building, is architect.

The General Foundry & Machine Co., McDonald, Pa., has bought several acres of land along the Pennsylvania railroad from the Allegheny Forging Co., which purchase, with buildings and machinery, involved a stated sum of more than $100,000.

Iron City Sanitary Mfg. Co., Zelienople, Pa., plans 1-story, 90 x 360-foot factory of steel and brick construction. C. A. Fagan, 1512-6 Oliver building, Pittsburgh, is president. The company operated gray iron foundry.

Florida Machine Works, Jacksonville, Fla., has completed a new plant for manufacture of iron and brass castings and forgings. An electric furnace for steel castings production is being installed. Machinery from the old plant will be moved into the new. F. G. Russell is proprietor. Company operates gray iron, brass and aluminum foundries.